JOURNAL

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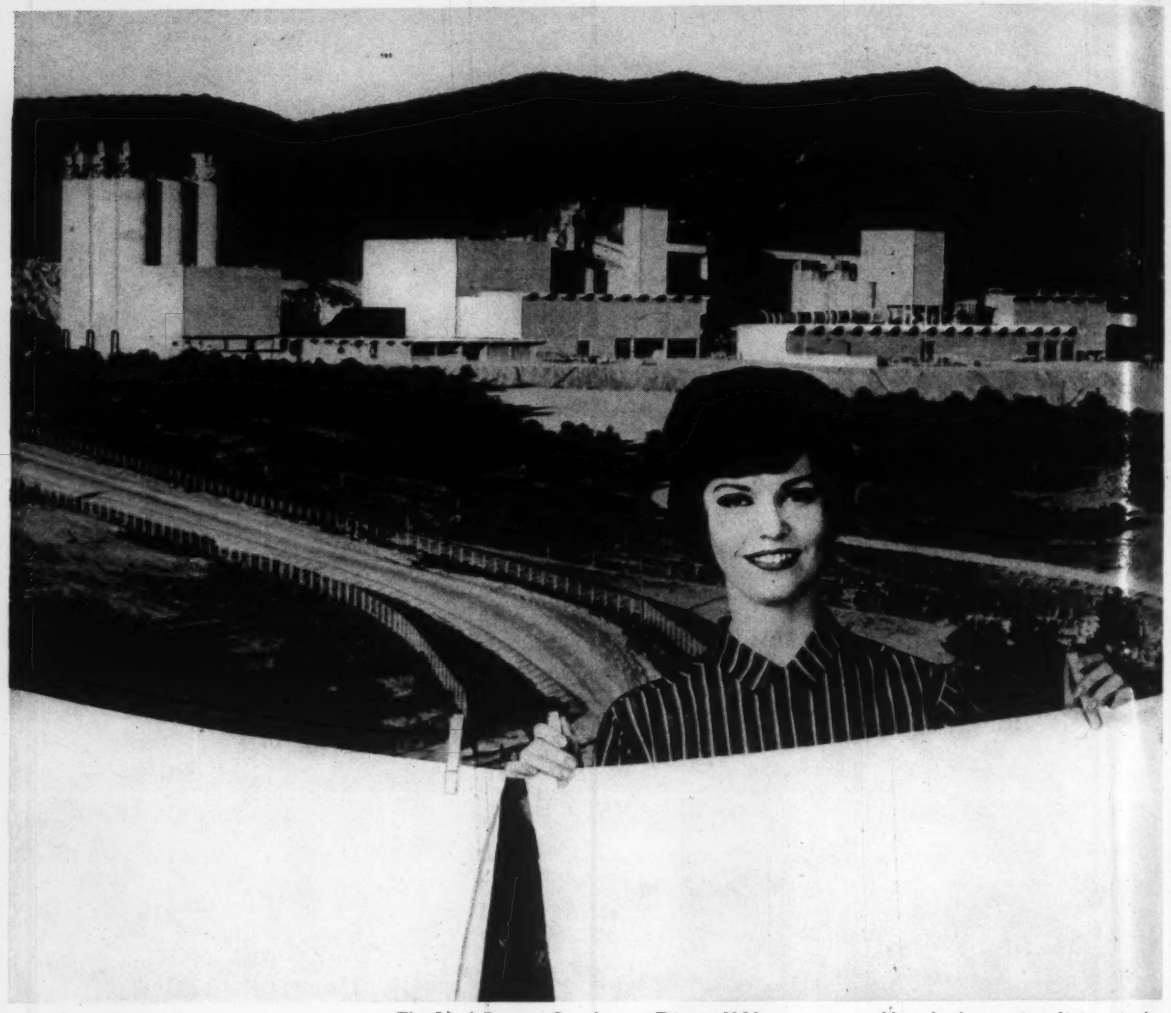
AIR POLLUTION CONTROL ASSOCIATION

SCIENCE & TECHNOLOGY

Founded 1907

TACKS

S. Smith Griswold, First Vice President of APCA



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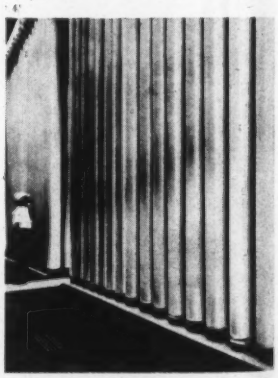

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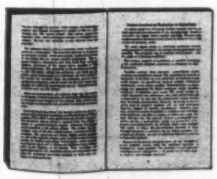

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LETTERS to the EDITOR

Committee TI-7—Information Reports No. 5 and 6.

Editor:

The light scattering properties of metallic oxides and condensed grease droplets produce plumes that are easily observed by general citizens, foundry operations and control agency employees, alike.

Several communities that wish to reduce their man-made haze are using this "plume opacity" as a legal tool. They do this by comparing the opacity of white plumes with the equivalent opacity of black and gray plumes of different Ringelmann shades produced in oil-fired furnaces that are specially controlled for training inspectors and factory employees.

Trained "opacity" observers read "equivalent Ringelmann opacity numbers" with a consistency and reproducibility that are surprising to newcomers in this field of work.

We therefore must take strong issue with that part of the Foundry Industries' reports No. 5 and 6, Committee TI-7, pages 233–236, May 1961, *APCA Journal*, which rejects the use of Ringelmann Equivalent Opacity legal requirements as now established in our communities.

Sincerely,
BENJAMIN LINSKY
Air Pollution Control Officer
San Francisco Bay Area

APCA Elections Held at Meeting

At the 54th Annual Meeting of APCA, four vice presidents were elected to office: S. Smith Griswold, First Vice-President; Morton Sterling, Vice President of Control; R. L. Ireland, Vice President of Industry; and Vernon G. MacKenzie, Vice President of Research and Education. Howard C. Davies was re-elected Treasurer for the 11th succeeding year.

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SECRETARY'S PAGE

APCA WELCOMES MAPPA

May 24, 1961, will be a date long remembered in APCA's 54-year history. This marked the date of APCA's Board of Directors' official approval of the petition of the Midwestern Air Pollution Prevention Association as a local section.

In its petition for recognition, MAPPA recognized the fact that mutual benefit would be derived in a merger of two organizations having common interests and purposes. The geographic boundaries of the MAPPA section will include the counties of Cook, DuPage, Will, McHenry, Kane, and Lake in the State of Illinois; the counties of Lake and Porter in the State of Indiana, and any other midwestern area not otherwise represented in APCA. APCA's entire membership welcomes its eighth section and wishes it a long and successful life in the affairs of the Association.

Significantly enough, the consolidation takes place simultaneously with the official announcement of the 55th Annual Meeting dates of May 20 to 24, 1962, at the Chicago-Sheraton Hotel in Chicago. MAPPA will be the host section for this meeting and consequently immediately begins to assume a role of great importance in APCA's affairs.

Local sections are the grass roots of any large technical society. The membership activity of local sections is bringing in new membership in large numbers to APCA. It is envisioned that many more local sections will soon be activated and furnish the impetus for increased membership. In addition, local sections furnish the medium for activity of members who cannot get to annual meetings—they help make APCA's activities much broader than a four-day-a-year organization. Last, but not least, local sections furnish a forum for better public relations and understanding in areas where these techniques for better air pollution control activities are desired.

Older APCA members who knew the late Frank A. Chambers, Secretary for 43 years before his death in 1951, will feel that somehow his spirit guided this affiliation of MAPPA and APCA. He would certainly add his blessings and wishes for success.

Help Boost APCA Membership

CLASSIFIED

METEOROLOGIST. Under general direction to plan and co-ordinate meteorological studies in relation to air pollution and its control. Salary: $7000 to $8480. Qualifications: Bachelor's degree including or supplemented by 20 semester credit hours in meteorology and three years of professional meteorological experience. Graduate study in meteorology may be substituted for experience on a year for year basis. Write to R. H. Mattox, Personnel Director, New York State Department of Health, 84 Holland Avenue, Albany, New York.

CALENDAR

September 21–22	East Central Section Annual Technical Meeting, Louisville, Kentucky.
October 16–17	International Conference on Ionization of the Air, The Franklin Institute, Philadelphia, Pennsylvania.

FOUNDED 1907

JOURNAL OF THE AIR POLLUTION CONTROL ASSOCIATION

A Monthly Journal
Devoted to
Air Purification

Editor: Arnold Arch
Associate Editor: Pat Truschel
Assistant Editor: Pat Martin

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Air Pollution Control Association
Printed in the United States

AIR POLLUTION CONTROL ASSOCIATION
4400 Fifth Avenue
Pittsburgh 13, Pa.

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The Editor welcomes writers interested in air pollution problems and encourages them to use the pages of this journal for the expression of their opinions, But neither he nor the Association assumes responsibility for the validity of the opinions expressed herein.

THE JOURNAL OF AIR POLLUTION CONTROL ASSOCIATION is published monthly with editorial and executive offices at 4400 Fifth Avenue, Pittsburgh 13, Pa.

Second class mail postage paid at Pittsburgh and at additional mailing office.

Subscription price $15.00 per year.
Foreign subscription $20.00 per year.

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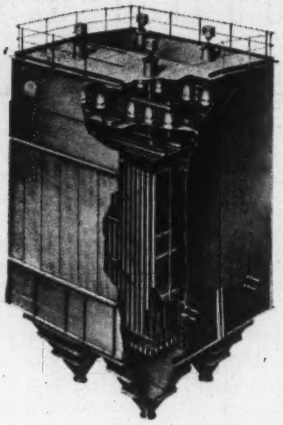
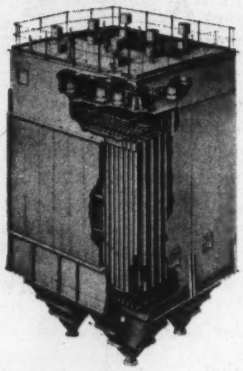
Complete Sets of Available Preprints Can Be Obtained Through Headquarters

How Important Is Precipitator Size?

Traditional Design →





Modern Design ←

As shown in these two illustrations, Research-Cottrell's more compact modern design is appreciably smaller than the traditional design.

A common fallacy assumes a larger precipitator with lower gas velocity is preferable to a smaller precipitator with higher gas velocity.

This assumption overlooks important economies now obtained with:

(a) Efficient voltage application.

(b) Specific control of electrical sections.

(c) Electrode design improvements.

(d) Automatic Rapper Control.

(e) Accurate internal baffling.

(f) Proper control of gas flow, based on three-dimensional model studies.

Close familiarity with these techniques and improvements has made possible guarantees of 99 per cent collection on large, modern installations.

A. Applied Voltage

The relationship between voltage and size of the precipitator is approximately as shown in Figure 1.

Most efficient operation and minimum size are obtainable by insuring operation at maximum voltage under varying conditions of gas flow, particle size, resistivity, etc. Generally, the amount of arc-over in the precipitator will determine the practical operating voltage limit. By using the arc-over as the motivating control factor, through measurement and integration, maximum voltage can be insured at all times.

B. Sectional Voltage Control

Since gas conditions vary throughout any precipitator, higher efficiencies are obtainable if the precipitator is sectionalized with individual voltage control for each section.

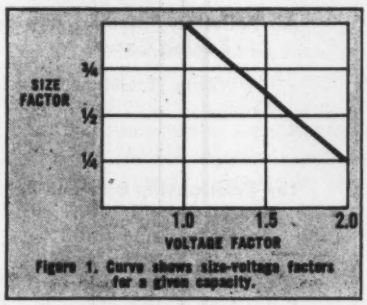


Figure 1. Curve shows size-voltage factors for a given capacity.

C. Electrode Design

Efficiency can be seriously affected by re-entrainment (that is the re-suspension of dust that has already been collected). Properly designed collecting electrodes, or plates, providing correct baffling to shield the collecting surface against the sweeping and scouring effects of the gas stream can reduce overall precipitator size 25–50 per cent.

D. Automatic Rapper Control

Rapping intensity must vary to meet the changing conditions of gas flow, particle size and resistivity. Otherwise, efficiency will decrease due to either too heavy a blow causing a re-entrainment, or too light a blow allowing dust build up on the electrodes necessitating operation at reduced voltages. Automatically controlled, fully adjustable rapping equipment insures optimum operation at all times.

E. Internal Baffling

Maximum efficiency can only be obtained by reducing the sneakage (part of gas stream which leaks or sneaks around the treatment zone) to an absolute minimum through the proper design and use of internal baffling proven by model studies and research on full size precipitators.

F. Gas Flow—Model Studies

Proper gas flow patterns across the face of the precipitator can result in a 25–50 per cent reduction in over-all size. The use of transparent plastic three-dimensional model studies as well as field research has resulted in refinements in design never before possible.

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For details or more information relative to the data contained herein, or any other general inquiries, please contact your nearest Research-Cottrell representative or write directly to:

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AIR POLLUTION *from the* GRAIN *Industry*[*,†]

MALCOLM E. McLOUTH, P.E., Chief, Air Pollution Control Engineer, Minneapolis, Minn., and
HAROLD J. PAULUS, Ph.D., Associate Professor, School of Public Health, University of Minnesota, Minneapolis, Minn.

For several years the University of Minnesota Health Service has been concerned with an apparent higher than normal incidence of asthma among the students. In past years, "outbreaks" of asthmatic attacks, usually accompanied by certain weather conditions, have occurred in the student body. Speculation as to the cause of this health problem has been directed to the grain industry which is a dominant factor in the Twin City industrial picture, especially in the campus area.

The potential exposure of the University students to emissions from the grain industry can be better understood after a study of Fig. 1. In this figure the relative locations of the University of Minnesota campuses, the main student housing areas, and the grain mills and plants are shown on a map of the area. Of the 23,500 full time students enrolled at the University, approximately 11,000 reside within a two mile radius of the Minneapolis campus. Grain elevators and plants in the map area represent only about 1/3 of the total number of grain industry plants in the Metropolitan city area but essentially all operations and processes are included.

This paper covers a general discussion of the grain industry in the Twin City area, lists the basic operations with a description of each one, discusses the primary sources of air pollutants, and the controls presently employed in the industry. A preliminary report is made of the dispersion of particulate contaminants from the grain mills adjacent to the campuses, however, no conclusions are reached regarding the association of asthma with the grain industry.

The Grain Industry

Over 300 million bushels of different types of grain are shipped into the Twin Cities each year.[1] Wheat shipments comprise approximately 40% of this total with barley 20%, corn 15%, oats 15%, and rye, flax, and soybeans making up most of the remaining 10%. The principal agricultural area served by the Twin Cities includes Minnesota, Montana, and North and South Dakota. About 1 1/4 billion bushels of grain are grown in these states each year according to the U. S. Dept. of Agriculture. In addition to the grain received in the Twin Cities, approximately 150 million bushels are shipped out of the region by lake transport through Duluth-Superior and most of the remainder is fed to livestock on the farm.

A total of 76 grain elevators with a storage capacity of 124 million bushels and seven flour mills with a daily milling potential of 2415 tons are located in the Twin City Metropolitan area. The size and the operational activity of the different plants varies widely. The elevators in which government grain is stored remain relatively idle throughout the year. Other elevators are used for grain merchandising and the amount of grain handled may reach 15 times the storage capacity each year.

The potential dust problem from the grain industry in the Twin City area can be estimated if the following assumptions are made: all grain received has an average of three percent dockage, and the grain is cleaned once with dust collectors operating at 90% efficiency by weight. From the 300 million bushels brought into the area about 22,500 tons of fine dust would be spread around the plant areas each year. This amount represents 0.3% of the basic materials used in the grain industry and compares favorably with other estimates of food product emissions.[2] In general the emitted dust would be smaller than 10 microns in diameter since the collection characteristics of most control devices used have this limitation. This estimated amount of fine dust emissions would represent a substantial contri-

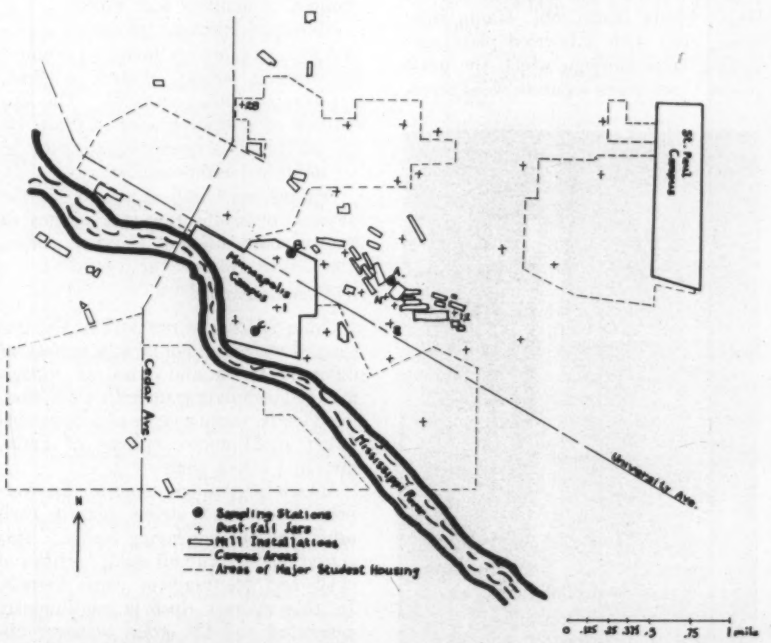

Fig. 1. Map showing locations of grain mills in relation to university campuses, areas of major student housing, and sampling sites.

* A portion of this work was performed under NIH grant R.G. 6404.
† Presented at the 53rd Annual Meeting of APCA, Netherland-Hilton Hotel, May 22-26, 1960, Cincinnati, Ohio.

Table I—Particulate and Odor Sources in the Grain Industry

Process	Particulate Emissions														Odor Emissions	Type of Collecting Equipment
	Grain Operations										Miscellaneous					
	Unloading	Loading	Cleaning Rail Cars	Cleaning Grain	Turning	Blending	Sizing	Separating	Grinding	Loading Dust Cars	Tank Vents	Housekeeping	Exhaust from Dust Collectors	Plugged or Faulty Equipment		
Grain handling, cleaning, storage	M	M	A	M	S	S	S	S	—	M	S	A	M	M	—	Cyclones and a few baghouses
Animal food production	M	S	S	S	—	S	—	—	A	S	S	S	M	A	A	Cyclones
Linseed and soybean oil processing	M	—	S	A	—	—	—	—	A	M	S	S	A	A	M	Cyclones and multicyclones
Malting of barley	M	—	S	M	S	—	S	—	—	M	S	A	M	M	S	Cyclones and a few baghouses
Milling of grain	M	S	S	S	—	S	—	—	—	M	S	S	S	S	—	1/2 Cyclones and 1/2 baghouses
Grain dust grinding	M	M	S	S	—	—	—	—	M	M	A	A	M	A	—	Cyclones

Key: M—major source of contaminants. A—moderate source of contaminants. S—relatively small amounts of emissions. Blank—not applicable or negligible amounts of emissions.

bution to the air pollution load in the vicinity of the plants.

Operations and Processes

Grain Handling, Cleaning, and Storage

Almost all grain industry plants handle, clean, and store grain as a part of their operation. There is a wide variation in the extent to which the different plants engage in these activities. Certain operations (described below) expose grain to physical movement and are major sources of particulate emissions from the grain plants.

Unloading—Grain is removed from box cars or trucks, weighed, and transferred to a storage tank.

Loading—Grain is spouted for distances up to 100 feet into a prepared box car, truck, or river barge.

Cleaning—Foreign materials, broken kernels, chaff, and grain hairs are removed by means of scalpers, screeners, and aspirators. The scalpers remove large objects (corn cobs, tramp iron, wood, etc.) with a beveled plate containing holes through which the grain passes. Screeners separate weed seeds, small stones, dust, dirt, and other small objects from the grain. Aspirators remove chaff, grain hairs, and other lightweight contaminants by blowing air through the moving grain.

Fig. 2. Dust generated while unloading box car.

Sizing—Grain is sized by passing the kernels across a series of plates perforated with holes of varying width and length.

Storage—Constant checking of stored grain is required to prevent mold formation and insect infestation. Temperature sensing devices placed in the grain are continuously monitored to detect any increase in temperature which would indicate possible infestation. A temperature increase of five to 10°F in a week's time may require immediate fumigation or turning. To insure proper summer storage grain is usually turned (transferred from one tank to another) during cold days in the winter. In large tanks, grain temperatures as low as 20°F will remain unchanged in summer and winter.

Blending—Different grades of a certain type of grain are mixed to produce the desired weight, protein content, moisture, or other variable. The upgrading of inferior grades of grain by the addition of a superior grade may be accomplished in this manner.

Separation—Grain separation is the physical reclassification of a mixture of two or more different types of grains.

Air Contaminants

Grain is usually received in the uncleaned state and contains a variety of different types and sizes of foreign material including grain bran, chaff, rust, weed seeds, various types of pollens, different mold spores, pieces of grain, dirt, and insect parts.

Whenever grain is handled, the kernels scrape and strike against each other and the conveying media. This action tends to rub off small particles of chaff and to fragment some kernels. In this manner dust is continuously generated and the grain is never absolutely clean.

Air contaminant emissions from the above operations in the different grain processing plants are shown in Table I. A relative rating of major, moderate, small, and negligible sources of particulate and odor emissions is given for each category. Unloading and loading of grain are the dustiest operations that occur throughout the grain industry. (See Fig. 2.)

Animal Food Production

Four large plants are devoted to the manufacture of formula animal feeds in the Twin Cities. Animal food production is highly specialized with a typical mill preparing as many as 80 different products. Basic food ingredients will vary somewhat depending on market conditions, crop success, local availability, and formula requirements. Corn, oats, barley, soybean meal, and middlings (wheat bran from flour mills), constitute about 80% of the formulation. Other additives include screenings, tankage, fish meal, bone meal, alfalfa, flax meal, molasses, calcium, and phosphate.

Process stages are as follows:

1. Oats, corn, barley, screenings, and other ingredients are ground in a hammer mill.
2. Materials are mixed in either a batch or continuous operation. Most dry mixes are continuous with molasses being added in a batch process.
3. The mixtures are moistened with steam and forced through a multiholed die to produce pellets.

Air Contaminants

The main dust source is the unloading of the bulk grains and grain byproducts. Alfalfa is extremely dusty and must be handled with care to prevent an excessive emission. Other dust sources are associated with grain grinding and pelletizing. Strong and unpleasant odors constitute the most bothersome emission from this process. Pelletizing of a high protein hog feed containing large amounts of tankage and bone meal has been an annual

spring air pollution problem because of the odor.

Linseed and Soybean Oil Processing

Four large processing plants convert 16 million bushels of flax into linseed oil each year. These plants utilize the same equipment and process to produce soybean oil during certain periods of the year.

In the production of linseed and oil these steps are followed:

1. Flax seed is cleaned and crushed between a set of pressure rolls producing soft cake.
2. Steam is passed through the crushed mass to facilitate oil removal by expansion of the fibers.
3. Moisture content of the mass is reduced by passing dry air at 230°F through a screw type conveyor.
4. All but four percent of the oil is pressed from soft cake in a continuous automatic screw expeller. The extruded residual, called hardcake, is ground into a flaky form in a hammer mill.
5. Flakes are treated with hexane to extract all but 1/2% of the remaining oil then heated in kettles to drive off residual hexane and moisture.
6. Flax meal is toasted to convert the proteins to a digestible form, cooled, bagged, or sold in bulk for animal feed.
7. Linseed oil, extracted in the expeller, is tapped off into a large settling tank. Impurities called "foots" settle out and are returned to the expeller. The oil is cooled and passed through a set of fine screens to remove the residue.
8. Linseed oil refining consists of washing with water and caustic, bleaching, and a final filtration.

Air Contaminants

The major dust producing operations occur during handling, cleaning, and storing of grain and handling and flaking of seed meal. Odor producing compounds in the form of gases, mists, or particles are emitted in the expelling operation, in the toasting of meal flakes, and refining of the linseed oil.[3] Certain plants dispose of rancid oil and other by-products by combustion producing smoke and odors.

Malting of Barley

Barley malt is used in the brewing industry and as an additive for certain foods such as breakfast cereals, bread, flour, and candies. Minneapolis is one of the main malt producing centers primarily because of its location in the barley growing area. Most of the malt produced is used locally in the brewing and food industries but some is shipped to other communities. A number of elevators specialize in cleaning and sizing barley for shipment to other malting companies throughout the United States.

The malting process consists of the following steps:

1. Clean, sized grain is placed in steep tanks, washed, and saturated with moisture.
2. Moist grain is allowed to germinate under carefully controlled temperature and humidity conditions for four to five days.
3. A large rotating kiln drys the malt and knocks off the sprouts.
4. Malt is separated from sprouts and other wastes which are sold as animal feed. Finished malt is shipped to breweries or food manufacturers.

Air Contaminants

Air contaminants would primarily be dust emissions caused by the unloading, cleaning, and sizing of the grain. A continuous source of dust is created as the barley hull is scraped off in handling operations. Large quantities of this dust are collected at barley elevators and sold for use in animal feeds. Barley and rye dust are considered by grain handlers to be the most irritating of all grain dusts. Toasting of finished malt gives off a coffee type odor which is offensive to some people.

Milling of Grain

Wheat is the primary grain milled in the Twin Cities with lesser quantities of oats, corn, and rye. The operations necessary to mill different grades of grains are essentially the same but the end products may be quite varied as illustrated by the numerous varieties of flours, breads, breakfast foods, special mixes, and other foods.[4] In one local mill six grades of wheat are used to produce twenty different types of flour with the aid of additives, bleaching, and blending.

The following steps are taken in flour milling of wheat:

1. Different grades of wheat are mixed to produce the desired blend.
2. Cleaners scalp, screen, and aspirate the grain to remove foreign material and dust.
3. Moisture is added by washing the grain to toughen the outside layer of bran so that it will come off in large flakes. Bran is undesirable in flour and is difficult to separate in the powdered state.
4. Grain is fed through a number of successively smoother rolls until it is reduced to its finished form. A screening operation between each set of rolls helps control particle size and separates out the bran. The bolters or sifters are also gradually reduced in effective mesh sizes down to a fine silk sieve. The finished product includes clear (rough) and pattern (fine) flour which is usually blended in a 30 to 70% ratio.
5. Additional processing may include bleaching, enrichment, and bromating.

Air Contaminants

Air contaminant problems encountered in milling are primarily dust emissions from the movement of raw grain. Emissions from the milling operation are well contained within the building by the use of a closed dust cleaning system. Moisture problems, excessive heat loss from make-up air, cost of flour dust, explosion hazards, and fine particle size of the mill dust have encouraged the installation of feed back air handling systems utilizing cloth type filters. Loading of middlings and chaff in rail cars is an extremely dusty operation.

Grain Dust Grinding

A unique mill in Minneapolis receives screenings from elevators and prepares this material for inclusion as a filler in animal food preparations. Weed seed allowance in the pulverized screenings is limited to one percent germination in an effort to prevent the spread of weeds through the use of animal feeds. The following steps are taken:

1. Material is unloaded from the cars and transferred to storage bins.
2. Dust passes through scalpers and cleaners to remove all foreign objects (discarded) and broken grain kernels which are sold as a poultry feed.
3. Screenings are passed through a hammer mill for destruction of weed seeds.
4. Pulverized dust is loaded out in rail cars.

Air Contaminants

The major emission from this operation is fine grain dust generated from unloading boxcars into a hopper below tracks, from the pneumatic handling system, the hammer mills, cleaners, and from loading out boxcars with the finished product. Owing to the nature of the material processed in this plant the effluent from the cyclone control system is clearly visible and is of such magnitude that it has frequently been mistaken for smoke.

Miscellaneous Operations

Certain operations in general use throughout the grain industry are potential air pollution sources. These include loading grain dust cars, housekeeping, and fumigation of grain.

Loading grain dust cars, one of the dustiest operations in the grain industry,

Fig. 3. Leaking cyclone patch causing dust deposits on a mill roof.

consists of transferring screenings accumulated by collectors from a dust tank into a railroad car. A dust grinding mill may load up to five cars a day as compared to a large storage elevator which may ship out five to 10 cars a year. Loading of a dust car generally requires extensive probing of the matted dust mass, an extremely dusty operation. The dust is spouted into the rail car under positive air pressure forcing dust laden air out into the atmosphere.

Housekeeping of a mill or plant is a continuous task that must be satisfactorily accomplished for safety reasons. (See Fig. 3.) Accumulation of dust on rafters, walls, and floors can cause several problems including an explosion potential.[5] The insurance rates of a dusty mill is a factor that encourages good housekeeping practices. Pneumatic systems are usually incorporated in mills to facilitate cleaning operations. Removal of grain spilled on mill property is also a problem as it may mildew and rot resulting in odor emissions.

Insecticides and pesticides, used for the control of grain infestation, are an additional source of air contamination. Highly toxic materials such as carbon disulfide, carbon tetrachloride, methyl bromide, ethylene dichloride, and chloropicrin are used as fumigants to protect grain in storage. Vaporized fumigants are forced through the grain bin from the bottom and either exhausted at the top or returned to the base in a closed system. Owing to the rapid turnover of grain and the colder climate the problem of grain spoilage is not as great in elevators, plants, and mills of the Twin Cities as in those of other areas.

Control of Emissions

The cyclone dust separator is the main dust collecting device used for control of particulate air pollution from the grain industry. These inertial collectors effectively remove grain dust particles as small as 20 microns in diameter and will collect about 90% by weight of all types of dust emitted by grain operations.[6] Multicyclone installations are used in special situations such as the exhaust from the flax meal toaster. General use of this type of control equipment in the industry is not advisable because grain dust tends to plug up the small entrance openings. Multicyclones are generally more efficient than the larger cyclones and will remove particles as small as five microns from the air stream.

Cloth filters have been used for a long time for the control of dust emissions from the grain industry. Cyclone exhausts are piped to a large plenum chamber covered on one side with cloth. Baghouse filter installations are now receiving wide application in the grain industry.[7] Cloth filters of this type collect dust as small as 0.5 micron in diameter at weight efficiencies close to 99%.

Electrostatic precipitators and wet collectors have been used as control equipment on a limited basis. High costs, dust explosion hazards, and the necessity of a dry by-product are reasons for only special use of these devices.

Proper exhaust hooding of dusty operations is necessary for dust control.[8] Grain unloading and loading, the dustiest operations, are best controlled in enclosed or semi-enclosed areas under negative pressure to prevent the escape of dust laden air. Baffles are used to contain dust and to direct air flow at boxcar unloading operations. Properly hooded dust sources in the plant will reduce the task of housekeeping. General ventilation is usually provided by opening doors and windows or by an exhaust fan with no collection device. Closed systems incorporating baghouses are used in flour mills where recirculation of the exhausted air is desired.

Gaseous emissions from the processing and refining of linseed oil, soybean oil, and animal food production have not been effectively controlled by the industry.

Maintenance Problems

In the mill area adjacent to the campuses of the University of Minnesota, over 200 large cyclones are used for dust control at grain industry operations. It has been found that many of these cyclones will be inoperative an average of about two times a year due to plugging. From this source large amounts of nuisance dust have been deposited periodically on the ground, roof tops, automobiles, and neighboring property. Active maintenance can reduce the problem of plugged cyclones which are usually caused by a buildup of dust in the clean air exhaust duct or dust removal tube.

Fig. 4. House cleaning with compressed air.

The abrasive quality of grain causes another maintenance problem that requires attention. As kernels slide down spouts, hit baffles, or pass across metal surfaces, leaks develop in the system allowing dust to escape. (See Fig. 4.) A small hole in a cyclone separator or pressurized spout can be a major dust source if it is not quickly repaired. Routine maintenance checks and replacement of critical wearing surfaces will reduce the unnecessary pollution from these sources.

Recommended Controls

Presently available dust collection equipment if properly designed and maintained could reduce the amount of particulate emissions from the grain industry to a reasonable minimum. Although some plants utilize the latest and best equipment for each particular situation, considerable improvement could be made throughout the industry. For the collection of dust laden air, baffling of exposed grain drops, negative pressures in bins, rail cars, and conveyors, and local exhaust hoods at emission points should be used at the necessary locations. Separation of dust from the air stream is best accomplished by the use of bag collectors. In the winter the cleaned air may be returned to the process area to reduce heating costs. Special bulk feed and grain rail cars will reduce dust emissions during loading and unloading operations. These rail cars have discharge hopper bottoms, sectional compartments, and top spout openings, all of which help to reduce dust emissions.

Other measures that would help in

Table II—Total Weight and Organic Content of Samples Collected by Dustfall Jar at Five Locations

Location No.	Total Weight (Tons/sq mi/month) Range	Average	Organic Content (Percent of Total Weight) Range	Average
1	11.3–123.6	42.5	15–47	27
8	17.2–81.9	38.6	24–58	39
11	29.3–137.0	66.3	30–59	46
12	78.296.4	150.9	31–80	65
28	26.5–187.6	63.2	17–36	25

Description of jar locations
No. 1—On main campus, about 1/2 mi from main mill area.
No. 2—About 1/8 mi from nearest mill.
No. 11—150 yd from grain mill activities.
No. 12—Surrounded by mills, within 30 yd of mill structure.
No. 28—In commercial area, 1/2 mi from main mill area.

Table III—Weight of Particulate Matter Collected by High Volume Sampler at Three Locations

Sampling Locations	Total Weight (Micrograms/cu Meter of Air) Range	Average
A	101–519	243
B	25–402	161
C	42–168	98

Location No. 1—On warehouse roof in mill area—25 ft above ground.
Location No. 2—Adjacent to campus—1/4 mi from mills—12 ft above ground.
Location No. 3—University Health Service roof, on campus—1/2 mi from mills—25 ft above ground.

reducing the problem include warning devices for cyclone plug ups, easy flowing dust tanks, chemical deodorizers, disposal by sanitary land fill, incinerators, catalytic combustion of certain gaseous exhausts, prompt removal of organic wastes or spillages, and a thorough maintenance program on all grain or dust handling equipment.

Particle Dispersion Study

A study is being made of the dispersion of grain dust and other particles from the grain industry plants located in an area between the University of Minnesota Campuses. Particulate matter is being collected in dustfall jars and by high volume samplers at locations shown in Fig. 1.

In the dustfall study, 30 spots were selected at random locations in a six square mile area including the grain plants and campuses. In addition, two control stations were selected, one in downtown Minneapolis and the other in a residential area. Dustfall jars were placed on electric power poles using an especially designed jar support. Each sampling spot was carefully selected to minimize as much as possible the effect of local sources on particle collection.[9]

Samples collected over a two week period were analyzed for total weight of particulate matter and for organic content by ignition of the samples. In Table II the results of nine months sampling are shown for five jar sampling locations.

Particulate emissions from the grain industry operations would normally be high in organic content because of the nature of the material handled. While it is apparent that the grain industry emissions do influence samples collected relatively close to the mills (locations 11, 12) this influence diminishes rapidly according to the distance from the mills (locations 8, 1, 28). Although results from only five locations are shown the same trend was noted in the rest of the data. For purposes of comparison the average fall-out of particulate matter as determined by dust fall jars located at control points in residential and commercial areas was 17.5 and 27.2 tons/sq mi/month respectively.

Analysis of the high volume samples collected at three locations as shown in Fig. 1 support the dustfall jar data. The range and average weights of particulate matter obtained over a seven month period with two samples weekly appear in Table III. Samples collected at location A when compared with those obtained at locations B and C demonstrate how the grain industry operations contribute to the particulate pollution in the atmosphere. These samples are being analyzed for total protein content which is a good index for grain dust.[10]

Summary

In the Twin Cities, the many elevators, mills, and plants of the grain industry comprise a substantial portion of the industrial picture. Millions of bushels of grain are processed into human and animal foods and other products each year in plants scattered throughout the area. The air contaminants from the grain industry operations consist of various sizes and types of particles from grain handling operations and certain odor producing compounds from linseed and soybean oil processing and refining, animal food production, and other processes.

Grain unloading and loading, considered to be the dustiest operations, are carried on by essentially all types of mills and plants. Grain dust collected at the mills is utilized in animal food preparations after being prepared in a dust grinding mill. Handling of the collected dust and dust grinding to destroy weed seeds are extremely dusty operations that contribute substantial amounts of pollution to the atmosphere.

Most of the dusty operations are exhaust ventilated through collection systems. Cyclone separators are the most commonly used collectors with baghouse filter installations gaining in prominence in recent years. For special situations in grain operations electrostatic precipitators and multicyclones are being used.

Preliminary results of a study on the dispersion of dust from the grain industry plants indicate a considerable influence on the total particulate pollution in a limited area.

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STOCKHOLDERS INFORMED COMPANY 'IN THE RACE'

An announcement was made to stockholders of W. R. Grace and Company that the company was "in the race" to produce a chemical that would cut down the obnoxious and unhealthy exhaust gases from automobiles.

J. Peter Grace, president of the company with diversified and international interests, showed 400 stockholders the prototype of a new automobile muffler that had been tested for 25,000 miles.

It contained a chemical catalyst that "not only will remove smog-causing hydrocarbons, but it will also remove carbon monoxide exhausts," he said.

If it is approved for public sale, Mr. Grace promised the stockholders, "it will be a very substantial business."

The research was sparked by legislation adopted in California. It will require motor vehicles in that state to be equipped with anti-smog mufflers when it approves two systems.

LEGAL ASPECTS *of* STATE *Versus* LOCAL *Control**

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In the development of the laws controlling air contamination, the reflective student may observe striking phases marking the progress of control efforts. In the early days, there were few statutes, and the individual inflicted with air pollution from a particular source had to rely on the common-law doctrine of nuisance.† This civil remedy was adequate when the dust, which killed the vines on Blackacre, could be traced to the local cement works.

The next phase was the enactment of municipal smoke and health ordinances. Cities such as London, Pittsburgh, and New York discovered a new phenomenon; a sickly pall enshrouding the city, made up of emissions from many and varied sources. Control of smoke based on the character of the emission or of the fuel was the logical remedy. Some American cities are only now entering this phase.

The third phase, control by state statute or by regional entity, is now in progress. This development was, of course, partially initiated by the realization that air masses, contaminated in one city, damage not only the residents of that city but of surrounding areas as well. Increased urbanization and the megalopolis accentuated the need for something more than local regulation.

We will soon be entering a fourth phase. It is now recognized by all thoughtful persons concerned with air pollution control, that an effective over-all air pollution control program requires the allocation to each level of government that responsibility which it is best qualified to undertake. That allocation is the subject of this presentation.

As we have noted, most air pollution control historically has been the function of the local agency. In later paragraphs, the particular functions which the state (and the federal government) can best fulfill, will be discussed. However, I believe that without a doubt the fundamental power and responsibility for air pollution control lies with the local agency, not with the state.

We in California, like the people of many states, are jealous of our local "home rule" tradition, which is written into the state constitution. This is more than an historical accident. The American Revolution and the present nationalistic trend in Africa and Asia are similar evidences of the normal desire for self-determination.

It cannot be denied that in some instances, the agitation for local control may result from selfish interest which can influence a locality, but not the state. On the other hand, in the County of Los Angeles, air contaminators which are hard pressed by firm local regulations often have petitioned the State Legislature for relief.

The advantages of local control are obvious. Briefly, some of them may be noted as follows:

1 Control may be tailored to the problem. This may be the most important factor of all. Air pollution as we know it manifests itself in different ways and in different degrees, depending upon local climate and meteorology, population density, the type of industry, the popular fuel, local prosperity, and the availability of mass rapid transit, among other factors.

State control is seldom if ever flexible enough to meet these differing conditions. Moreover, state legislatures reflect a cross-section of interests. Representatives from agricultural areas, for example, just cannot support strong measures which would burden their constituents to help only their city cousins.

2 Economy. Local agencies have good control over their own budgets. They know how much is being spent, and for what purposes. Local elected officials must (if they are to stay in office) show a dollar's worth of value for each dollar spent. On the other hand, when a dollar in tax money flows from the local agency through the state or federal treasury and back, that dollar will have been reduced by the cost of collecting the tax and redistributing the money, plus overhead and additional unexplained reductions. If one thing is certain in government, it is that a local effort to meet a local problem will be more efficient and less costly than a state or federal program.

3 Taxation with representation. Local governments are close to the needs, desires, and voices of the people. If any serious problem exists in a city, the people, the newspapers, and other media of communication are all aware of it. The city fathers must face these people, at meetings, in their offices, on television, and at the polls. Unless that city can muster a majority of the members of the state legislature (a very uncommon condition) a state program to solve their problem may be met with indifference, or even with hostility. A symptom of this is observable at present in California, where there is under way a strong move to reapportion the State Senate. The reason for this campaign is a strong feeling that the so-called "cow county" senators are turning a deaf ear to the needs of the urban communities.

Other advantages of local air pollution control are discussed below. One must be careful, however, not to overstate the case for local control. To this end, the role of the state, and of the federal government, is discussed in subsequent sections.

The Responsibility of the Local Agency

In nearly all states, cities, and counties, by statute or constitutional provision, are granted the "police power." This is a very broad legal concept. For our purposes here, it is the power of government to protect people and their property from injury. In the first instance, of course, the police power is reserved to the states (United States Constitution, Amend-

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* Presented at the 53rd Annual Meeting of APCA, Netherland-Hilton Hotel, May 22–26, 1960, Cincinnati, Ohio.

† English smoke abatement statutes date from the year 1273. However, with few exceptions, control by statute in the United States is a product of the Twentieth Century.

ment X). To the local agency it is a "delegated power."

It should be borne in mind that the police power delegated to cities and counties is not all-embracing. The state may take such power unto itself by direct enactment or by occupying the field. (*In re Iverson*, 199 Cal. 582, 250 Pac. 681.)

Within these limitations, and within constitutional principles such as due process and equal protection of the laws, the power of a city or county to regulate air contamination is essentially complete.

Specific Delegation of State Power by Legislature

Regulation of specific matters is sometimes granted to municipalities by the legislature. Thus, in Talldega vs Fitzpatrick, 133 Ala. 613, 32 So. 252, it was held that the municipality could prohibit riots under a specific delegated power. See also: Hicks vs City of Dublin, 56 Ga. App. 63, 191 S.E. 659, and Chicago vs Union Ice Cream Mfg. Co., 252 Ill. 311, 96 N.E. 872.

Conflict Between Municipal Ordinances and State Statute

It is the general rule that there cannot be a conflict between local ordinances and the state law, unless the state law itself allows the difference. Ex parte Hoffman, 155 Cal. 114, 99 Pac. 517; State vs Dannenberg, 150 N.E. 799, 63 S.E. 946. Under this rule an ordinance ordinarily cannot permit that which the statute forbids, or prohibit that which a statute in effect directs to be permitted. For example, in the case of Cain vs Daly, 74 S. C. 480, 55 S.E. 110, it was held that a license to conduct a business does not allow opening of it on Sunday, in violation of a state law. As a general rule, ordinances may add additional restrictions to those established by state law. (Borok vs Birmingham, 191, Ala. 75, 67 So. 389; Sternal vs Strand, 76 Cal. App. 2d 432, 172 Pac. 2d 921.) In a number of states, ordinances which cover the same acts as the state statutes are invalid. The most common theory for so holding is that to allow both to stand would result in double jeopardy. See: State vs Welsh, 36 Conn. 215, 28 Atl. 28; State vs Dannenberg, 150 N. C. 799, 63 S.E. 946.

Powers Under "Home Rule" Charters

The police power of a municipality is in many cases derived from constitutional charters. This power is usually limited to matters of local concern (Wilson vs Zanesville, 130 Ohio St. 286, 199 N.E. 187; People vs Osborne, 17 Cal. App. 2d Supp. 771, 59 Pac. 2d 1083; State vs Brunello, 67 Idaho 242, 176 Pac. 2d 212), but it is sometimes said that the police power of chartered cities is as broad as that of the state. (Seattle vs Ford, 144 Wash. 107, 257 Pac. 243.) It should be clearly understood that the police power of cities is never inherent in the city, but comes by delegation from a higher source, by constitutional, statutory, or charter provision. (Leighton vs Minneapolis, 16 Fed. Supp. 101; Denninger vs Pomona Recorders Court, 145 Cal. 629, 79 Pac. 360; Commonwealth vs Plaisted, 148 Mass. 375.) The power of the particular city is limited by the grant. (Fieldcrest Dairies, Inc., vs Chicago, 122 Fed. 2d 132.)

Control by Ordinance

Probably the earliest United States case upholding a municipal smoke control ordinance is that of City of New Orleans vs Lambert, 14 La. Ann. 247 (1859). There the Louisiana Supreme Court approved an injunction by a city against the operation of a blacksmith shop because it emitted offensive odors and smoke, and was a nuisance, all in violation of a city Ordinance. Today there is no doubt that such control by ordinance is a proper exercise of the police power.*

Liberal Construction of Ordinances

It can be said fairly that the courts will liberally construe air pollution control regulations in favor of the city. For example, in Penn-Dixie Cement Corp. vs City of Kingsport, 189 Tenn. 450, 225 S.W. 2d 270, 275 (1949), the court stated:

> "Ordinances to preserve the public health have been liberally construed and the authorities have gone to great length in enumerating the implied powers of municipalities to enact laws to protect the community from infectious and contagious diseases, from bad water, against nuisances injurious to health and noxious odors and gases. Inasmuch as the provision of the public health and the safety of the inhabitants is one of the chief purposes of local government, all reasonable ordinances in this direction have been sustained."

The court in People vs Consolidated Company of New York, Inc., 116 N. Y. S. 2d 555 (1952), found that the Smoke Control Bureau of the City of New York acted under the police power of the City of New York in promulgating its rules and regulations, and that such rules and regulations are remedial and must be liberally construed.

For other cases where the court used a liberal construction, see Department of Health of City of N. Y. vs Philip and William Ebling Brewing Co., 38 Misc. 537, 78 N. Y. S. 13 (1902), and People vs Long Is. R. Co., 31 N. Y. S. 2d 537 (1942).

Ordinances Must Be Reasonable and Certain

Any ordinance or statute under the police power must be reasonable, and for that reason must regulate or forbid something which is or could be considered detrimental to the public peace, health, safety, morals, or general welfare. If any set of facts may be supposed as to which a law or ordinance is reasonable, or if reasonable minds may differ on the question, the enactment will be sustained. Matter of Miller (1912) 162 Cal. 687; Clemons vs City of Los Angeles (1950) 36 Cal. 2d 95, 98–99, 222 P. 2d 439; Miller vs Board of Public Works, 195 Cal. 477, 488–490, 234 P. 2d 38. Where the ordinance or statute passes this test, a naked violation of the ordinance is all that need be shown.

The legislature has a wide discretion in determining what is a nuisance and what is not, and what may be regulated under the police power. In doubtful cases, the determination of the question by the legislative body is conclusive. The courts will not interfere unless the law results in needless oppression, and will not question the wisdom of the legislation. But the courts are not limited to the face of the law itself. The courts may look behind the law and determine from competent extrinsic evidence whether or not the law is reasonable. Moses vs United States, 16 App. D. C. 428; Bradley vs District of Columbia, 20 App. D. C. 169; State vs Tower, 185 Mo. 79, 84 S.W. 10 (1904); Cincinnati vs Burkhardt, 30 Ohio Cir. Ct. Rep. 350, Ann. Cas., 1918 B. 174 (1908).

In the case of Moses vs United States, *supra*, the court said:

> "The policy of adopting a regulation to meet the conditions is a matter purely and exclusively within the province of the legislative department. The judiciary can only interfere with the exercise of the power where it is manifest that the regulation has no real or substantial relation to objects within the police power, and constitutes a palpable invasion of private rights."

It can be seen that what is reasonable depends upon the circumstances. No hard and fast rule can be established for all cases. It has been urged that legislation regulating the use of bituminous coal is unreasonable, especially in a district where soft coal is produced in large quantities, and where such

* An early English statute controlling industrial fumes was the Alkali Act of 1863. The general form of the statute today remains unchanged although its scope has been expanded.

coal is universally used for fuel. It is argued that to enforce a law of this character would require industry to use expensive anthracite or other smokeless fuel causing great hardship, and perhaps, driving many plants from the city. This contention was easily refuted by the Supreme Court of Illinois in the case of Harmon vs Chicago, 110 Ill. 400, which disposed of the objection as follows:

> "It may be that some, and, perhaps, very great inconvenience would be experienced by a rigid enforcement of the provisions of this ordinance. How that may be this court cannot know. What powers the city council may exercise under the general law or under its police powers is a question of law to be determined by the courts; but when the city council will exercise the powers with which it is clothed rests in its legislative discretion, and the consequences that may flow from the enforcement of ordinances enacted within the powers conferred, rests along upon the body enacting them, and with which the courts have no concern."

In State vs Pond, 93 Mo. 618, the court said:

> "With the policy of the law, the wisdom or want of it in its enactment, we have no concern; that belongs to the domain of the legislature. Our business is to declare what is law and not to make law."

Actual damage in a particular case need not be shown to sustain a conviction under an ordinance. In State vs Mundet Cork Co., (1952) 8 N. J. 359, 86 Atl. 2d 1 at 6, the court said:

> "Further, actual injury to health or property is not necessary to the proof of conviction of violation of the ordinance, since whether persons or property are or may be injured by the continued exercise of the prohibited conduct or industrial operation is relative to the question of reasonableness of the ordinance and not to the question of fact as to what constitutes violation thereof."

After holding a smoke ordinance prohibiting the emission of smoke of greater density than No. 2 Ringelmann to be a valid public health measure, the court in Board of Health of Weehawken Township vs New York Central Railroad (1950) 4 N. J. 293, 72 Atl. 2d 511, 514–515, said:

> "At common law, an action of nuisance will lie for substantial discomfort or inconvenience. But the inconvenience must be more than fanciful; it is not actionable unless it is one 'materially interfering with the ordinary comfort physically of human existence, not merely according to elegant or dainty modes and habits of living, but according to plain and sober and simple notions among the English People.' Walter vs Selfe (1851) 4 DeG. & Sm. 322. The common law judges by no Spartan standards. The loss of even one night's sleep is not deemed a trivial matter. Andreae vs Selfridge (1937) 3 A. E. R. 261; Salmond on the Law of Torts (10th Ed. 1945) 224. Of course, the standard of convenience and comfort varies according to local conditions and needs. It suffices to say as to this that the conditions constituting a nuisance at a given time and place may not be a nuisance at another time and place. And it may be added that the complexities of our modern society due in large part to congestion of population and concentration of industry and business impose an ever increasing demand for individual concessions to the common good . . ."

In the case of City of Brooklyn vs Nassau Electric R. Co., 61 N. Y. S. 33 (1899), an action was brought to recover from defendant a penalty of $100 for using soft coal in contravention of a statute providing:

> "No factory, engine room or electrical station shall use what is known as soft coal for fuel . . . within a radius of four miles of the city hall . . ."

The court held that it was within the police power of the legislature to declare that the burning of soft coal within certain prescribed limits of the city was detrimental to the public welfare and that the same shall be forbidden as a benefit to the general public.

> "Ordinances must not only be reasonable and within the power of the municipality to enact them under its charter, but must affect each member of the community alike. They should neither favor nor discriminate against any person or class of persons or any particular portion of the municipal territory. Their burdens and their benefits should rest equally upon all." (People vs Lewis, 86 Mich. 273, 49 N.W. 140, (1891).)

In the above case the court held as not unreasonable an ordinance which provided that private residences and steam boats be excluded from the ordinance declaring the emission of dense smoke that caused the deposit of soot on any surface within the corporate limits to be a public nuisance.

In the case of State vs Tower, *supra*, the general assembly of the state had passed an act in 1901 which made the emission or discharge into the open air of dense smoke within the corporate limits of this state which now have or may hereafter have a population of 100,000 inhabitants a public nuisance. The statute exempted owners of premises who may be able to show to the satisfaction of the court that there is no known practical device to prevent the emission of dense smoke. The court upheld the Missouri statute as valid and reasonable.

In the case of Moses vs United States, *supra*, sustained by the court in the case of Bradley vs District of Columbia, *supra*, an act of Congress provided:

> "The emission of dense or thick black or gray smoke or cinders from any smoke stack or chimney used in connection with any stationary engine, steam boiler, or furnace of any description within the District of Columbia shall be deemed and is hereby declared to be a public nuisance; provided that nothing in this act shall be construed as applying to chimneys of buildings used exclusively for private residences."

The act provided for a fine of from $10 to $100 for each offense and that every day in which the provisions were violated constituted a separate offense.

The judgment of conviction by the police court of the District was affirmed and the ordinance upheld. The court held that the power of Congress to enact regulations affecting the public health and comfort was the same as that of the legislatures of the several states within their respective territorial limits.

In sustaining the ordinance the court quoted with approval from Lawton vs Steele, 152 U. S. 133, as follows:

> "'To justify the state in thus interposing its authority in behalf of the public it must appear, first, that the interests of the public generally, as distinguished from those of a particular class, require such interference; and, second, that the means are reasonably necessary for the accomplishment of the purpose, and not unduly oppressive upon individuals. The legislature may not, under the guise of protecting the public interests, arbitrarily interfere with private business, or impose unusual or unnecessary restrictions upon lawful occupations. In other words, its determination as to what is a proper exercise of its police powers is not final or conclusive, but is subject to the supervision of the courts.'"

The court further stated:

> "Nothing short of satisfactory proof that under no circumstances smoke occasion material injury, in-

convenience, or discomfort to the public would, at most, be sufficient to show that the statute, under the guise merely of the public interest, was an unwarranted invasion of private right."

In Cincinnati vs Burkhardt, 30 Ohio Cr. Ct. Rep. 350, Ann. Cas., 1918 B, 174 (1908) an ordinance which provided for the measurement of the density of smoke by use of a color scale was upheld.

In Bower vs City of Indianapolis, 162 Ind. 105, 81 N.E. 1097, 13 Ann. Cas. 1198 (1970), an ordinance was upheld which declared the emission of dense smoke within the city, except from private residences, to be a public nuisance. The state had given cities authority by statute to declare what should constitute a nuisance.

In re Junqua, 10 Cal. App. 602, 103 Pac. 159 (1909), was a case in which an ordinance of the city of Sacramento prohibiting the escape of any soot from smoke stacks or chimneys of any furnaces using distillate or crude oil was upheld.

In City of Rochester vs Macaulay-Fien Mill Company, 199 N. Y. 207, 92 N.E. 641, 32 L.R.A. (N.S.), 554 (1910), the court held reasonable an ordinance of the City of Rochester which provided for the adoption of the standard of the Ringelmann Scale, prohibited dense smoke during the day except from between 5 AM and 7:30 AM, and which permitted the emission of dense smoke for five minutes in every four consecutive hours.

In People vs Tatje, 121 N. Y. Supp. 2d 147 (1953), the defendant was charged with unlawfully causing suffering and allowing dense smoke to be emitted into the open air from a chimney attached to a boiler in the premises under his control. The court held that the rule prohibiting emission of dense smoke from fuel burning equipment was not invalid as conflicting with penal law and Health Board Regulations requiring landlords to furnish heat and hot water to tenants.

The case of Ballentine vs Nester, 350 Mo. 58, 164 S.W. 2d 378 (1942), is one of the leading cases on the subject of reasonableness of air pollution control ordinances. In the Ballentine case the Supreme Court of Missouri held valid an ordinance of St. Louis, passed in 1940, regulating the smoke nuisance.

The petitioner in the case had been convicted of violating a section of the St. Louis Ordinance prohibiting the use of coal, having a volatile content of more than 25% on a dry basis. In his petition for a writ of habeas corpus, the petitioner asserted that the ordinance violated the Fourteenth Amendment of the Federal Constitution, the Revised Statutes of Missouri, and the St. Louis Charter. The court denied the petition, upholding the conviction and the validity of the ordinance.

In reaching its decision, the court cited and quoted with approval from the case of Northwestern Laundry vs Des Moines, 239 U. S. 486, and stated:

> "... Nor do we think this section, in regulating the use of coal, violates the due process and the equal protection of the Fourteenth Amendment of the Federal Constitution."

As to the claim of petitioner that the ordinance did not always regulate noxious gases, the court said:

> "It is true the ordinance makes only the emissions of dense smoke unlawful; it contains no provision that tends to regulate or prevent the discharge of deleterious gases into the air. The legislative authorities may classify with reference to an evil to be prevented, and legislation designed to prevent one evil is not void because it does not prevent another."

The case of Glucose Refining Company vs City of Chicago, 138 Fed. 209 (1905), involved a Chicago ordinance passed in 1903, which ordinance declared that the emission of dense smoke was a public nuisance, and prohibited the emission of dense smoke for more than three minutes, or, in case fire boxes are being cleaned or new fires started, for more than six minutes in any hour of day or night.

The complainant attempted to enjoin enforcement of the ordinance, asserting that it violated the Federal Constitution. The court denied the injunction on the ground that the bill admitted the issuance of dense smoke, and the court took judicial notice of the fact that such smoke was a nuisance and spread over a large territory.

In 1955 the United States Supreme Court (351 U. S. 990, 100 L.Ed. 1503) dismissed an appeal from the decision handed down by the Appellate Department, Superior Court, Los Angeles, involving four separate cases each of which involved one or more charges and convictions of smog violation. People vs Plywood Manufacturers of Calif.; People vs Shell Oil Co.; People vs Union Oil Co.; People vs Southern Calif. Edison Co.; 137 C. A. 2d Supp. 859; 291 P. 2d 587.

The defendants stood charged and convicted of violating Section 24242 of the Health and Safety Code. Section 24242 provides:

> "A person shall not discharge into the atmosphere from any single source of emission whatsoever any air contaminant for a period or periods aggregating more than three minutes in any one hour which is:
>
> "(*a*) As dark or darker in shade as that designated as No. 2 on the Ringelmann Chart, as published by the United States Bureau of Mines, or
>
> "(*b*) of such opacity as to obscure an observer's view to a degree equal to or greater than does smoke described in subsection (*a*) of this section."

Directly involved was subdivision (*b*) relative to opacity of emission. The Appellate Department, after recalling its prior decision in People vs International Steel Corp. (1951), 102 Cal. App. 2d Supp. 935, 226 P. 587 that the standard made use of in subsection (*a*) is sufficiently definite to satisfy due process, went on to say:

> "Subdivision (*a*) only begins to solve the problem of the discharge of contaminants into the air; it does not touch smoke and other substances too light in shade to come up to Ringelmann No. 2. They may be so substantial in nature, however, that they make it impossible to see an object on the other side We have all seen very white smoke that shut out the view completely. Again they may obscure the view to a lesser degree than totality . . .
>
> "We may, therefore, express the test of subdivision (*b*) in simple terms; it condemns smoke or any other contaminant that is at least as hard to see through as is smoke which is as dark or darker than Ringelmann No. 2. There is nothing mystic or incomprehensible about such a statement."

The court in upholding the validity of subsection (*b*) of the statute dismissed the contention made by appellants that Section 24242 was unconstitutional for uncertainty under the theory that an ordinary person, having no special training, will not be able to tell whether certain smoke is as dark as Ringelmann No. 2, or whether its opacity equals that of smoke matching Ringelmann No. 2, by stating:

> "A statute is invalid if its terms leave that which it attempts to control shrouded in uncertainty, but a statute which declares an act, identified with certainty; to be unlawful is not rendered unconstitutional because the act, as a fact, may not be readily identifiable by the common man as that forbidden by the statute."

Ordinances May Classify Reasonably

Here involved is the "equal protection clause" of the federal Constitution. Many states have similar constitutional provisions. Equal protection is not a requirement which is absolute; that is,

reasonable classifications of persons may be established. These classes may either be exempted, or be the only ones controlled.

In Moses vs United States, 16 App. D. C. 428, the statute exempted chimneys of buildings used exclusively for private residences, while declaring the emission of dense or thick black or gray smoke of cinders from smoke stacks or chimneys to be a public nuisance. The statute was upheld.

In State vs Tower, 134 Mo. App. 352, 114 S.W. 1104 (1908) the court sustained a conviction under a Missouri statute prohibiting dense smoke in cities of more than 100,000 except where no device for compliance existed. It was shown that the defendant was using a boiler to which no device could be attached.

In Atlantic City vs France, 75 N. J. L. 910, 70 Atl. 163, 18 L.R.A. (N.S.) 156 (1908), the court upheld an ordinance which made it unlawful to permit the emission of dense smoke from any stack connected with any engine or locomotive within the city limits, which smoke contained soot or other substances in sufficient quantity to cause injury to the health or damage to property within the corporate limits of the city, and which made no distinction between locomotive engines operated on railroads and any other kind of engine.

The Validity of an Ordinance Does Not Depend on Whether the Emission Constitutes a Nuisance

The police power of the state, or of the municipality or other local agency when properly authorized by the state, extends to the regulation of air pollution, visible or invisible, without regard to whether the condition constitutes a common law or statutory nuisance.

In Board of Health of Weehawken Township vs New York Central Railroad (1952) 10 N. J. 294, 90 A. 2d 729, 735, the court said:

> "The reason for a municipality making unlawful the emission of smoke is readily apparent. The issuance of dense smoke from a single chimney, in and of itself, may be altogether harmless and cause no inconvenience or damage to the public, but if smoke of like density issued from hundreds of chimneys, the contamination of the atmosphere would be substantial and the injury to the public considerable, yet for lack of the requisite elements of a public nuisance at common law, the municipality could obtain no relief by way of indictment. Ordinances making unlawful the emission of smoke are therefore obviously necessary and reasonable and a valid exercise of the local police power."

See also: People vs International Steel Co. (1951) 102 Cal. App. 2d Supp. 935, 226 P. 2d 587.

In State vs Mundet Cork Corp. (1952) 8 N. J. 359, 86 A. 2d 1, at 3–4, the court said:

> "The emphasis in this type of ordinance for centuries has been placed on smoke regulation. (In response to a petition by the citizens of London, a royal proclamation was issued by Edward I in England in 1306 to prohibit artificers from using sea coal, as distinguished from charcoal, in their furnaces, and making use of sea coal a capital offense . . .) In more recent generations other air pollutants have been subjected to control . . . Ordinances designed to regulate and control air pollution in the interest of the public health and welfare have been held valid and enforceable in this State . . ."

The validity of an ordinance or statute regulating the emission of smoke or fumes does not depend upon whether or not it is a nuisance. The validity depends entirely upon whether or not the law comes within the constitutional limitations and, in the case of a city, whether or not it has power under its charter or constitutional or statutory provisions to pass such a law. The police power permits the state to enact laws to forbid and regulate various practices to provide for the general welfare and comfort of the people, regardless of whether or not they constitute nuisances.

A leading case on the subject is the California case of *In re Junqua*, 10 Cal. App. 602, 605 (1909).

In this case the petitioner sought a discharge on a writ of habeas corpus to test the validity of a (Sacramento) city ordinance. The ordinance provided:

> "It shall be unlawful for any person, firm or corporation to permit any soot to escape from the smokestack or from the chimney of any furnace within the City of Sacramento in which distillate or crude oil is consumed as fuel."

The petitioner claimed that the ordinance was unconstitutional and void on its face, as under the ordinance it made no difference how little soot was emitted. The court stated:

> "That the police power is an inherent attribute of every state or commonwealth in the Union is a proposition which will readily be conceded. It is not only a power which inheres in the sovereignty of the states, but is a power the exercise of which by the states is indispensably essential to the health, peace, comfort and welfare generally of the inhabitants thereof . . .
>
> "This power embraces the right to regulate any class of business, the operation of which, unless regulated, may, in the judgment of the appropriate local authority, interfere with the rights of others, for, as is said in Dobbins vs City of Los Angeles, 139 Cal. 179 (96 Am. St. Rep. 95, 72 Pac. 970), all property is subject to the police power. In other words, the proposition cannot be maintained that the exercise of this power is confined to the regulation only of such interferences with the public welfare and comfort as come strictly within the common law definition of a 'nuisance' (Dobbins vs City of Los Angeles, *supra*.)"

See also: Buffalo vs George P. Ray Manufacturing Company, 124 N. Y. 931, Ann. Cas. 1918 B, 174 (1910).

Not all courts have been so cooperative toward attempts to reduce air contamination.

For example, in the case of Glucose Refining Company vs Chicago, *supra*, the court said:

> "... It is held in the case of Harmon vs Chicago, *supra*, that a Municipality cannot by ordinance make that a public nuisance which was not in fact such. The same rule is laid down in numerous cases and must be deemed a settled rule for the purpose of this motion."

In the case of the State vs Chicago, *supra*, the court stated:

> "It is elementary that the legislature cannot prevent a lawful use of property by declaring a certain use to be a nuisance which is not in fact a nuisance, and prohibiting such use."

Impairment to Health Is Not Necessary

Discomfort, inconvenience, and annoyance to the public is sufficient, and impairment to health is not necessary, to render the emission of smoke and fumes a nuisance, and also to permit its abatement by statute. 39 Am. Jur. 337, Note 19, Section 54; Moses vs United States, 16 App. D. C. 428, 50 L.R.A. 532; Judson vs Los Angeles Suburban Gas Co., 157 Cal. 168, 171, 173 (1910); Dauberman vs Grant, 198 Cal. 586, 48 A.L.R. 1244, 246 Pac. 319 (1926); State ex rel Krittenbrink vs Whithnell, 91 Nebr. 101, 135 N.W. 376, 40 L.R.A. (N.S.) 898 (1912).

In the case of Moses vs United States, *supra*, the court said:

> "Without reference to statutory regulations or declarations in a particular case, any use of one's

property, ordinarily lawful, may become a nuisance, not only when it produces injury to public health, safety and morals, but also when it occasions public inconvenience, or materially impairs the public comfort— 'the physical comfort of human existence.' "

In the California case of Judson vs Los Angeles Suburban Gas Co., *supra*, the plaintiff filed an action for damages and to abate a nuisance. The defendant had constructed gas works near plaintiff's home on the bank of the Arroyo Seco in Los Angeles. The smoke, odor and noise interfered with the comfortable enjoyment of plaintiff's property, but there was no evidence that plaintiff's health or that of his family was injuriously affected. The plaintiff complained that the smoke was so thick that it sometimes obstructed the landscape, had a penetrating odor, and at times strongly suggested a London fog.

The appellate court upheld the injunction and judgment for damages, and stated:

"In order that a judgment of this character may be upheld, it is not necessary that the health of plaintiff or of members of his household should have been impaired. It is sufficient if the odors, sounds, and smoke were offensive to the senses.

". . . A gas factory does not constitute a nuisance *per se*. The manufacture in or near a great city of gas for illumination and heating is not only legitimate but is very necessary to the comfort of the people. But in this, as in any other sort of lawful business the person conducting it is subject to the rule *sic utere tuo ut alienum non laedas*, even when operating under municipal permission or under public obligation to furnish a commodity . . . Nor will the adoption of the most approved appliances and methods of production justify the continuance of that which, in spite of them, remains a nuisance."

In the California case of Dauberman vs Grant, 198 Cal. 586, 48 A.L.R. 1244, 246 Pac. 319 (1926) the court held that the defendant could be enjoined from maintaining a nuisance where he maintained a smoke stack at such a low height that heavy black smoke and soot were carried into plaintiff's adjacent dwelling.

The court said:

"It was not necessary to the recovery of damages caused by the nuisance of smoke and soot to prove actual damage to plaintiff's property. She was entitled to recover for the personal discomfort and annoyance to which she had been subjected and it was a question for the trial court to determine the amount of compensation which she should receive."

See also: State vs Mundet Cork Corp. (1952) 8 N. J. 359, 86 A. 2d 1.

Thus impairment to health need not be shown. However, in a proper case the court will take judicial notice of the fact that air polluton is injurious to health. Penn-Dixie Cement Corp. vs City of Kingsport (1949) 189 Tenn. 450, 225 S.W. 2d 270, 275; Board of Health of Weehawken Township vs New York Central Railroad Co. (1950), 4 N. J. 293, 72 A. 2d 511, 514–515. In the Penn-Dixie case, the court said (at page 275):

"But this Court can and does take judicial cognizance of the fact that when the air is laden with a heavy cloud of smoke and dust that such a condition constitutes a nuisance and is detrimental to the health and safety of the public. When therefore the legislature confers upon a municipality authority to safeguard the public health, it is wholly unnecessary that the charter or general law should go further and declare that smoke and dust are detrimental to health. Everybody knows that it is . . ."

The Weehawken Township case (72 Atl. 2d at pp. 514–515) states:

"And there can be no doubt that the regulations under review have a substantial relation to the public health. Dense smoke, a carrier as it is of dust, soot and cinders, contaminates and pollutes the atmosphere and deteriorates its normal healthful attributes and qualities, and therefore cannot but be harmful to the public health, especially in populous areas. This is a matter of common experience, so much so that it is properly a subject of judicial notice."

Enforcement of Regulation

Local law enforcement is a tradition in American government. Even today, in most areas of the nation, the local chief of police and sheriff have practically the exclusive power and duty to enforce state and local law. There appears to be little controversy over the proposition that the enforcement of air pollution regulations should be vested in the city, the county, or the district. However, no analysis of state versus local responsibility would be complete without recognition of this important function.

Summary of Local Control

From the foregoing, I believe it is clear that the local agency is, and should be, the prime force in air pollution control. It has the power and the ability to perform the exact level of control which conditions dictate. One fairly extensive trend which should not be encouraged is the removal of many responsibilities from cities and counties, to the State Capital. Our experience in California shows conclusively that if a blighted area awaits help until the whole state is moved to action, then that area will wallow in misery for a long time. Unless local agencies act to solve their own problems (perhaps with enabling legislation) that protection which the state will provide will be reduced to the least common denominator—that level which the less infected areas will support, rather than the level which the hardest hit area must have. We have seen this principle demonstrated regarding water supply, health services, pollution (water and air), to name only a few.

The State Responsibility

The state, as the ultimate source of governmental power (Keller vs United States, 213 U. S. 138, 53 L.Ed. 737), is in an ideal position to assist local agencies in providing a really effective air pollution control program. In a few areas, it is the only entity which has the the power to act at all.*

Enabling Legislation

Local agencies are historically slow to adopt a comprehensive control plan. Without the boost of a state enabling act most cities and counties have been content with a few anti-smoke ordinances. A detailed plan contained in a state statute, which plan can be adopted by local agencies, must result (and in practice has resulted) in quicker, better, and more uniform local programs than could have resulted otherwise.

Creation of Districts or Authorities

Only the state has the power, in the first instance, to deal effectively with regional air pollution. For example, in Los Angeles County there are 68 separate cities, plus the county, each exercising its own police power. Concerted action by such a diverse group is, of course, impossible. However, the Air Pollution Control District, created under state statute in 1947, has authority to act throughout the county. On a larger scale, the trend in California is to multi-county districts created by the legislature (Calif. Health and Safety Code, Civ. 20, Chapters 2.5 and 2.6). Thus the state has created a new local agency to deal with the problem as it exists.

The Setting of Primary Standards

The state, with its financial resources and its primary responsibility in the

* A convenient digest of state air pollution laws was published in 1959 by the U. S. Department of Health, Education and Welfare (Public Health Service Publication No. 711). It is available at the U. S. Government Printing Office, Washington 25, D. C.

protection of the public health, is the natural entity to undertake the setting of standards of air quality. In the closely related field of industrial hygiene, this is already being done. One may envision that in the not too distant future, uniform codes on air quality will be as well established as uniform building codes are today. This will not happen until the individual states accept the duty, and conduct the necessary studies, to allow them to set realistic standards.

In California, the legislature, at its 1959 session, adopted two statutes aimed at the development of minimum standards. These statutes (Health and Safety Code Secs. 426.1 and 426.5) respectively required the State Department of Public Health to:

(*a*) Establish standards for air quality.

(*b*) Establish standards for the maximum allowable emissions for automobile exhausts.

In each case, provision is made for revision from time to time.*

Nuisance Abatement

One responsibility, which the state frequently has, is abatement, through the Attorney General of the state, of air pollution nuisances. Of additional interest to states having interstate nuisance problems is the fact that a state may protect itself extraterritorially. For example, in the case of State of Georgia vs Tennessee Copper Co. (1907), 27 S. Ct. 618, 51 L.Ed. 1038, the state of Georgia successfully enjoined a Tennessee plant from discharging noxious gases into the air. Mr. Justice Holmes, writing for the court, stated:

> "This is a suit by a state in its capacity of quasi-sovereign. In that capacity the state has an interest independent of and behind the titles of its citizens, in all the earth and air within its domain. It has the last word as to whether its mountains shall be stripped of their forests and its inhabitants shall breathe pure air . . . If the state has a case at all it is somewhat more certainly entitled to specific relief than a private party might be."

The difficulties arising from interstate air pollution doubtless could, of course, be solved more easily by compacts between states rather than by interstate litigation.

Local Air Monitoring

Air monitoring by local agencies has several obvious defects. Lack of uniformity, limited territorial scope, and fiscal limitations, are only a few of these. On the other hand, no foreseeable federal air monitoring program would be sufficiently concentrated to provide adequate data for local or state control efforts. Much time and money will be unnecessarily wasted until such data are provided. Of course, local air monitoring is only one category of special studies which states are often in the best position to conduct.

Control of Emissions from Motor Vehicles

Because vehicles are by definition mobile, local control is likely to be difficult and ineffectual. Regulation by Congress under the Commerce Clause of the Constitution, would seem all-embracing, but bills introduced to accomplish this have never progressed far. Moreover, many states have no serious problem from this source. Even if such legislation were adopted, one may predict with confidence that its standards would be a compromise rather than reflecting the serious problems of urban communities.

State governments have had considerable experience in regulating motor vehicles. State statutes now regulate automotive equipment, registration, taxation, and licensing. The records and procedures for adopting and enforcing regulation of air pollution from motor vehicles are already in existence in state governments. Those states with compulsory vehicle inspection laws are in an even better position. It can be seen readily that the control of air contamination from motor vehicles falls naturally within the sphere of state responsibility.

The great contribution of motor vehicles to the air pollution problem of cities has been known for many years. As early as October 27, 1953, the Air Pollution Control Board of Los Angeles County requested a legal opinion from the County Counsel on the proposition of adopting an administrative rule which would require automobile exhaust control devices on all new vehicles sold for use in Los Angeles County. That opinion advised the Board that because no such device existed it would be legally improper to adopt such a rule at that time.

In 1959, it became apparent to the Los Angeles County Air Pollution Control Officer, and to the Board of Supervisors of Los Angeles County, that the development of exhaust devices had progressed sufficiently to justify the enactment of enabling legislation to require the use of such devices. It was recognized that there is a substantial gap between the development of satisfactory test models and mass production of stock devices. On the other hand, the automotive industry, on October 25, 1959, through Charles N. Heinen, assured Los Angeles County officials that within one year after receiving legislative direction, the industry would be installing control devices on new cars at the factory. (Mr. Heinen is Chairman of the Vehicle Combustion Products Subcommittee of the Automobile Manufacturers' Association.)

The first major move was the unanimous adoption by the Los Angeles County Air Pollution Control Board of an eight-point program for motor vehicle air pollution control. That Resolution adopted April 7, 1959, requested the legislature and the Governor to take specific legislative steps toward control of automobile exhaust emissions. Bills were drafted and introduced into both houses of the state legislature (A. B. 2662 and S. B. 1323).

In brief, the proposed legislation would have provided for a complete system of exhaust control, from standards to inspection. Provision was also made for suspension of the requirement on the finding by a designated state officer that adequate devices were not available. Unfortunately, neither bill was reported out of committee.

Nevertheless some progess was made in 1959 when the legislature adopted the two important bills discussed above, (Health and Safety Code Secs. 426.1 and 426.5) which required the State Department of Public Health to establish and publish, by February 1, 1960, standards for air quality and maximum standards for exhaust emissions.

This was a vital step. It was followed by a vast amount of work (and some agitation) by a number of agencies. Among the agencies which developed a new legislative package were the Southern California Air Pollution Co-ordinating Council (consisting of several southern counties of California which have activated Air Pollution Control Districts), the County Supervisors' Association, the Subcommittee on Air Pollution of the Assembly Interim Committee on Public Health, as well as its expert Advisory Committee. The Co-ordinating Council and its member Boards of Supervisors prevailed upon the Governor to call a special session of the legislature in 1960 to deal with the specific problem.

At this writing the legislature of the State of California has just adopted by an overwhelming vote a bill which constitutes the first statewide air pollution control effort in the state's history. It is also the first comprehensive attack anywhere in the United States upon the automobile exhaust problem.† The new statute is set forth in the Appendix.

The statute, in brief, will:

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* These standards have been fixed by the State Department of Public Health.

† This bill was originated by Los Angeles County's Air Pollution Control Board (which is the Board of Supervisors), was supported by a large number of organizations and air pollution control districts. It is Assembly Bill 17, adopted at a Special Session of the California legislature, April, 1960, Chapter 23, Statutes 1960 (First Ex. Session).

1 Create a state board to test and certify exhaust control devices, as meeting the already adopted standards for exhaust emission.*

2 Require the installation of approved control devices on all new cars sold in California one year after devices have been approved.

3 Require the installation of devices on all used cars transferred in ownership in the first year, unless exempted by local option of county boards of supervisors; on all used commercial vehicles in the second year, and on all motor vehicles in the third year.

4 Appropriates one-half million dollars toward the program. That Governor Brown will sign the bill is indicated by the fact that he consented to call a special session of the legislature to consider the proposal.

One may ask why legislation cannot await the full development of near-perfect and inexpensive motor vehicle control devices. One answer is that about four years elapse, on the average, between the submission of a new proposal and its final enactment into law. Part of this delay is due to the fact that many state legislatures do not convene every year.

Probably a more important factor is the chicken-or-the-egg dilemma. A valid statute requires an available device. However, as we have seen the manufacturers are unwilling to commit themselves to a substantial production program unless and until they are assured that their particular product will be acceptable. The passage of this legislation, with its escape clause to deal with the possibility that unforeseen delay may occur, seems to be a practical escape from the dilemma.

We believe the adoption of these statutes is not only a major forward step in controlling air pollution, but also illustrates vividly a fundamental principle of state versus local control; that is, the state should and must step in to help local agencies in areas in which they cannot help themselves. Furthermore, a logical distinction can be made between stationary sources of air pollution, which can best be controlled at the local level and moving sources, such as pollutants from motor vehicles which can best be controlled at the level of the state.

Delegation of Powers to Cities

In some states the legislature has directly delegated authority in air pollution control to cities. Thus, the case of Glucose Refining Co. vs Chicago, 138 Fed. 209, among others, has established the validity of delegation by the state of Illinois of authority to the city of Chicago to enact smoke abatement ordinances. In the case of St. Paul vs. Gilfillan, 36 Minn. 298, 31 N.W. 49, it was held that a city could not make dense smoke a nuisance. A similar result was reached in St. Louis vs. Heitzeberg Packing Co., 141 Mo. 375, 42 S.W. 954. These cases illustrate that in a number of states it is the state's function either to define the air pollution nuisance or to delegate sufficient power to local agencies to deal with the problem.

The Designation of Administrative Power

The use of administrative regulations to control air pollution has been demonstrated to be effective, and has become ever more popular. Examples are found in the laws of the city of New York, (People vs Beverino, 112 N. Y. S. 2d 647), and the Statutes of California (Health and Safety Code, Div. 20, Ch. 2, Ch. 2.5, Ch. 2.6). The violation of such administrative regulation may be made a misdemeanor, but such action must be taken by an agency with power so to act. Thus, in People vs Beverino, *supra*, it was held that the city of New York could make violation of regulations of the Board of Smoke Control a misdemeanor. The applicable rule is set forth in People vs Grant, 242 App. Div. 310, 275 N. Y. S. 74, as follows:

> "The Legislature may delegate to administrative agencies power to make reasonable rules and regulations for administrative purposes and give to such rules and regulations the force and effect of law. United States vs Grimaud, 220 U. S. 506, 523, 31 S.Ct. 480, 485, 55 L.Ed. 563. In so doing it is providing for the administration of laws which the Legislature itself has enacted. It may declare the violation of these rules to be a crime and provide the punishment for their violation. In so doing, it is exercising the legislative power committed to its discretion by the people through the Constitution. The substantive portion of the legislation is found in that part of the statute which declares the violation of the rules and regulations to be a crime and prescribes the punishment for such violation."

The last sentence of the above quotation is most important. For example, in the case of Gilgert vs Stockton Port District, 7 Cal. 2d 384, the court held:

> "... the legislature has power to delegate to a port district to make reasonable rules and regulations for the administration of any branch of the state's business pertinent to the functions of the commission or board, but no such board or commission may declare a violation of such rules and regulations, when so established, to be a crime."

Summary of State Responsibility

The foregoing discussion points out in general terms the areas of air pollution control best occupied by state. It is apparent, however, that in particular factual situations the nature of the problem, the size of the state, and similar factors will broaden or narrow the area of responsibility which the state is best fitted to assume. As a general principle, however, it can be stated that no serious air pollution problem will be adequately met, without the full co-operation of the government of the state in which the situation exists.

The Federal Responsibility

It is almost the modern rule that any difficult problem with an expensive solution is eventually deposited upon the federal doorstep. In the case of air pollution, however, the record shows that local agencies, states, and private industry have borne the full effort, without waiting for federal assistance.

Since 1955, however (since the adoption of Public Law 159), the United States Department of Health, Education and Welfare has conducted, either directly or in supporting studies by experts, a variety of technical and medical studies. Particularly outstanding has been the co-operation of the Public Health Service in joint projects involving source studies and emission evaluations.

On the other hand, federal appropriations have been far too niggardly, considering the magnitude and gravity of the problem. The original statute (Public Law 159, 84th Congress, 1955) provided a maximum appropriation of $5,000,000 over a period of several years, and the Congress has not appropriated the maximum.†

A bill presently before the Congress, sponsored by Senators Thos. A. Kuchel and Clair Engle of California and Clark of Pennsylvania, would extend the time limit of the original statute, and (among other provisions) would eliminate the ceiling on appropriations.

The foregoing illustrate the responsibilities which the federal government has already assumed. The following illustrates some areas that the federal government is best fitted to undertake.

Technical and Medical Studies

It does not require a technical background to conclude that some elements of air pollution are constant or similar

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* California Health and Safety Code Sec. 426.5 as implemented by the State Department of Public Health.

† In contrast, government and industry in Los Angeles County alone spend an estimated $14,000,000 per year for air pollution control.

in all states. It is true that the nature of the emission and meteorological conditions vary greatly from place to place. On the other hand, refineries in Texas emit the same contaminants as those in Pennsylvania, and residents of New York are similarly affected by a given emission as those in San Francisco Duplicating efforts by states and localities must necessarily result in waste of both time and money, and this is no more logical than each state's attempting to launch an earth satellite, or financing its own Manhattan project.

A logical assignment for the federal government, then, is to collect the data and develop the technology which is common to various areas of the nation, and to act as a clearing house for information. This is no token effort, and its fulfillment will require both larger appropriations and an improved organization.

This last comment is no criticism of present activities. However, the Public Health Service has specialized divisions dealing with medicine, statistics, physics, and chemistry, to mention a few. All of these have air pollution responsibilities. As the program develops, it might be well to consider a division or separate agency whose sole or primary responsibility is air pollution control.

Control under Federal Power

The federal government does not possess the police power. (Hodges vs U. S., 203 U. S. 1, 27 S.Ct. 6, 51 L.Ed. 65.) It does have a power comparable to the police power of states when it is appropriate to the exercise of any attribute of sovereignty specifically granted to the federal government.

The governmental power over foreign and interstate commerce is vested exclusively in the Congress by the commerce clause of the Federal Constitution and is therefore withdrawn from the states. This does not prohibit reasonable local regulations. (Seaboard Air Line R. Co. vs Blackwell, 244 U. S. 310, 61 L.Ed. 1160.) On the other hand, it appears clear that the federal government is in the most advantageous position to control air pollution from vehicles in foreign and interstate commerce, including trucks, ships, and aircraft. See: Brooks vs United States, 267 U. S. 432, 69 L.Ed. 699; Roosevelt Field vs Town of North Hempstead, 88 Fed. Supp. 177.

It would be beyond the scope of this presentation to attempt to mention each federal power which could be applied specifically to the air pollution problem. As a general statement, however, it is clear that in the specific fields which constitute federal power—interstate commerce, navigation, air navigation, federal taxation, etc.—it is the responsibility of the federal government to take action to abate air pollution.

The first concrete attempt made in this direction was the introduction of a bill in the Congress (H. R. 9368, 85th Cong., 1st Sess.) by Rep. Paul F. Schenck of Ohio, in 1958. The author of this paper testified in support of such a measure when it was first considered by the House of Representatives Committee. That bill would have required the Surgeon General to determine health standards for unburned hydrocarbons from motor vehicles, and prohibit the use of motor vehicles in interstate commerce which cause discharges in excess of these standards. As noted, the bill was not adopted but the bill in modified form is still before the Congress and it is anticipated that at some future time it will be adopted by the Congress.

Federal Co-operation with Local Regulation

Whereas this is a minor element in the total problem, it should be noted that federal installations, many of which are immune from any state or local regulations, contribute to air contamination. It cannot be denied that it is the responsibility of the federal government to comply voluntarily with regulations so far as possible. See: 69 Stats. 322 (Public Law 159, 84th Cong. Ch. 360, 1st Sess.) and the President's Executive Order 10779 (1958).

Control by Treaty

The area of international air pollution control problems is not completely uncharted. The action of the International Joint Commission (appointed by Canada and the United States) and of the later created Arbitral Tribunal, in the famous Trail Smelter Case,* is an early example. There smelters of the Consolidated Mining and Smelting Co. of Canada, Ltd., at Trail, British Columbia, caused severe vegetation damage in Washington state.

More recent references of air pollution problems have also been made to the International Joint Commission under the Boundary Waters Treaty of January 11, 1909 (United States and Great Britain).

Summary of Federal Responsibility

We have seen that the primary responsibility for air pollution control appears to be vested in the locality in which the problem exists. Local control programs naturally tend to be more effective and economical than those undertaken by the state or the federal government.

The federal responsibility should be limited to those areas of endeavor which either cannot be accomplished by other agencies, or which are so universal in their scope or so expensive that only the federal government is really equipped to act. The extent of federal participation in the future will depend on how soon and how effectively states, cities, counties, and districts can adopt and implement their own measures. Local officials who look toward Washington for more than assistance in limited spheres will not only have to live with "smog" for a long time, but will be abdicating their own duties to the citizens they serve.

* See: U. S. Bureau of Mines Bulletin 453.

REMOVAL OF RAGWEED MAKES LIFE BEARABLE FOR HAY-FEVER VICTIMS

About the middle of August sufferers from the allergy known as "hay fever" will begin to experience the acute inflamation that expresses itself in sneezes, watering eyes, and plain misery. The cause of all this misery is pollen, principally ragweed pollen. The one way to make life more endurable is to banish the source by cutting ragweed or spraying it with a herbicide such as 2,4-D before it flowers and launches its pollen of grief upon the air.

One ragweed plant can pollute the air with five to eight billion pollen granules. One acre of ragweed pollutes the air with from 50 to 65 pounds of pollen each season. One square mile of ragweed pollen will liberate 16 tons of ragweed pollen during the season, much to the discomfort of the long-suffering hay fever patient. It is estimated that there are 10 to 12 million persons in the nation who are allergic to this air pollutant.

While it is true that some pollen may travel long distances, on wind currents, the eradication of the offending ragweed pollen-bearing plant at the source of contact with susceptible persons will lessen the degree of antigenic response and, in fact, would aid allergists in the over-all treatment of this allergy.

Experiments Conducted

Experiments conducted at the University of Michigan in June 1956, with ripe plants transplanted from greenhouses, demonstrated that the fall-out or loss of pollen grains from ragweed is as much as 98% of the total released, at a distance of 150 feet from the source. Ragweed pollens which are produced from plants growing close to where people live, travel, or play, are more toxic than the few grains which alight from a great distance.

With ragweed growing in every state of the Union and with 10 to 12 million sufferers in the United States, ragweed pollen is a serious air pollutant. Ragweed is an annual and it will not seed if destroyed before it flowers.

Air Pollution-Potential ADVISORY SERVICE *for* INDUSTRIAL ZONING CASES*

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For several years the Los Angeles County Air Pollution Control District has provided an advisory service to local land use planning and zoning agencies. Designed to provide land use planners with objective data and evaluations concerning the possible relationship between land use activities and air quality levels, the service has been provided since 1955 on a routine basis to both the City and County of Los Angeles. As presently administered, the zoning advisory service involves the development of estimates showing the possible effects on air quality of changes in existing land use patterns and use densities. It is designed to supplement, not to replace, other routine aspects of the air pollution control program.

Design and control of sources to assure operations in conformance with specific emission standards or prohibitions do not, in themselves, provide for the complete control of all contaminant emissions. Intermittent operator or mechanical failures may result periodically in the emission of substantial quantities of materials to the atmosphere. Uncontrollable increments of stack effluents also are added to the atmospheric pollution burden, even when the most technologically effective controls have been applied to the source. In the rapidly growing Los Angeles County metropolitan area, these source-control limitations have suggested the possible utility of land use planning and zoning as an adjunct to the source control program.

The inevitable result of the rapid growth of the County has been, and will continue to be, an increasing use pressure on available land areas, and a concomitant increase in the total air pollution potential of the County. Both growth and aging are occurring simultaneously in the community, with a resulting increase in pressure for use of both vacant and presently occupied land areas. As in other communities, encroachment of industrial-commercial activities on residentially zoned lands has occurred, and an increasing rate of residential construction on the periphery and in the midst of industrially zoned property also has occurred.

Nature of the Zoning Advisory Service

General Character

The potential usefulness of land use planning and zoning techniques has suggested itself in terms of two possibilities:

1 The development of long term comprehensive land use zoning plans which give consideration to the total air pollution potential of the future community as these relate to acceptable atmospheric burdens of air contaminants.

2 An interim program of co-operation and co-ordination to assure the availability of meteorological, air quality, and contaminant emission data to planning bodies considering specific zoning matters.

In Los Angeles County, no present application of the long term "master plan" approach seems feasible due to the lack of certain critical tools, data, and methods. Prerequisite to such a planning effort are reliable techniques for use in forecasting the type, quantity, and location of future industrial emissions; means for developing diffusion and dilution formulas applicable to specific land areas and zoning situations; the availability of acceptable community air standards for a variety of specific contaminants and their reaction products; and the availability of meso-meteorological data indicating specific dilution and dispersion parameters such as wind speeds and inversion height.

Presently lacking the potential for such a comprehensive and extensive planning activity, an interim program of data exchange and interagency co-operation and co-ordination has been established between the Air Pollution Control District and the local zoning agencies.

In California, jurisdiction over land use zoning matters has been assigned to local political subdivisions of the State, including charter cities, general law cities, and the county units of government. The zoning power of municipalities is confined to the corporate limits of the city, while the zoning authority of county units of government is confined to the unincorporated portions of the county. As a result of this allocation of zoning authority, Los Angeles County presently is serviced by 70 zoning jurisdictions representing 69 incorporated cities and the unincorporated portion of the County.

Two of these zoning jurisdictions, the City and County of Los Angeles, represent approximately 60% of the total population and land area of the most highly urbanized portion of Los Angeles County. This portion of the County, as shown in Fig. 1, has been legally defined as the Los Angeles Basin. The relative size of this area, as contrasted to other substantial urban areas throughout the United States, is suggested by Fig. 2.

The character of the industrial zoning advisory service extended by the Air Pollution Control District to these planning jurisdictions has been dictated by procedures customarily employed in the field of land use planning and zoning.

Generally, these procedures are concerned with three major types of transactions:

1. The creation of prescribed industrial zones
2. Change of existing land use descriptions to permit additional industrial activity or to permit nonindustrial activity in zone districts designed exclusively for industrial purposes; and
3. The issuance of special permits, variances, zoning exceptions, or conditional use permits within established zone districts.

* Presented at the 53rd Annual Meeting of APCA, Netherland-Hilton Hotel, May 22–26, 1960, Cincinnati, Ohio.

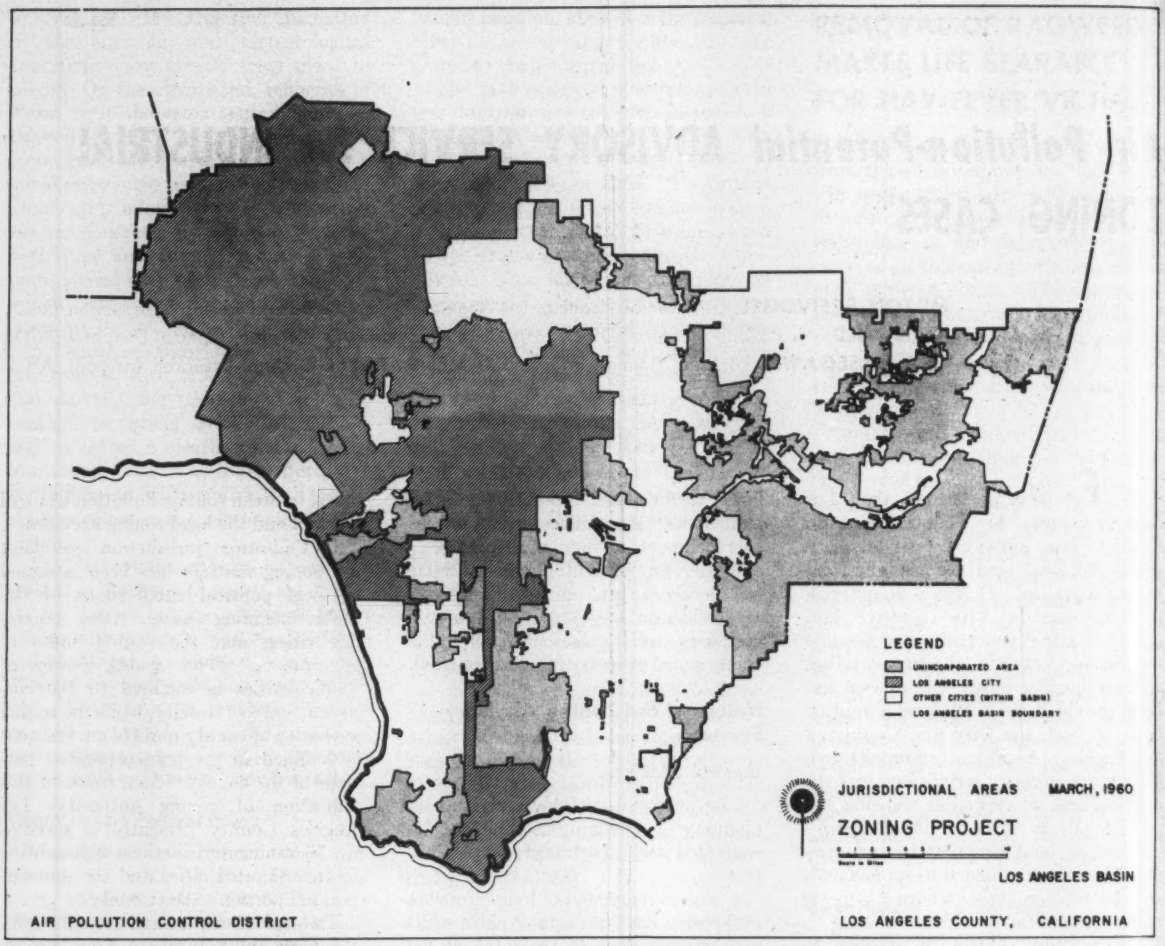

Fig. 1. Extent of Los Angeles Basin area covered by air pollution-potential advisory service.

The industrial zoning advisory service being performed by the District involves the development and evaluation of meteorological, air quality, and contaminant emission data to assist in the assessment of the effect of these types of zone transactions on general or localized air quality levels in the geographic areas in which zone transactions are to occur.

Prior to 1955, the advisory service was used sporadically by local agencies, upon request. Since that date, however, a routine relationship has been established between the District, the Los Angeles City Planning Commission, and the comparable body for the County of Los Angeles.

Emissions from Land Uses

The structuring of the advisory service has been partially dictated by established data showing the mass rate of contaminant emissions from traditional land use classifications. The traditional classifications employed by city and regional planners have divided land into primary categories of streets, industrial, commercial, and residential land uses. In Los Angeles County, quantitative and qualitative emission data have been applied to these characteristic land uses. These data may be developed on a process or per capita basis by methods such as those developed by Chass, et al.,[1] and Crouse, et al.[2]

The limitations of these emission data should be noted. Sudden changes in estimated emission rates may occur for the various land use categories as the result of increased production, new sources, substitution or elimination of sources, improved source control methods, or may be reflected numerically as a function of improved calculation methods or more accurate process loss data.

Significant also is the fact that contaminant emission data, when applied to a specific land area, do not necessarily indicate the air pollution problem potential of that area. Also to be considered are the entry and exit of air masses whose contaminant burden is a function of emissions from other areas, the dispersive and dilution capabilities of the atmosphere at any given time, and the reaction potential between various types of contaminating materials.

Shown in Fig. 3 are total 1959 Los Angeles County air pollution emissions classified by major urban land use. It is to be noted that "Streets" accounted for approximately one-half the emissions of organic gases, approximately one-third of the aerosols, and approximately three-quarters of the inorganic gases. Of the total, "Streets" accounted for approximately two-thirds of the total contaminant emissions.

The high proportion of contaminant emissions traceable to "Streets" in Los Angeles County is a partial result of the intensive source control program which has been applied to industrial, commercial, and residential activities. As control of contaminant losses from motor vehicles is realized and as projected growth trends continue, it can be expected that the relative contribution of industrial, commercial and residential land use activities will rise sharply. Although residential land uses contributed less than one percent of the total contaminant emissions in 1959, future increases can be expected, especially in the winter months as losses from space

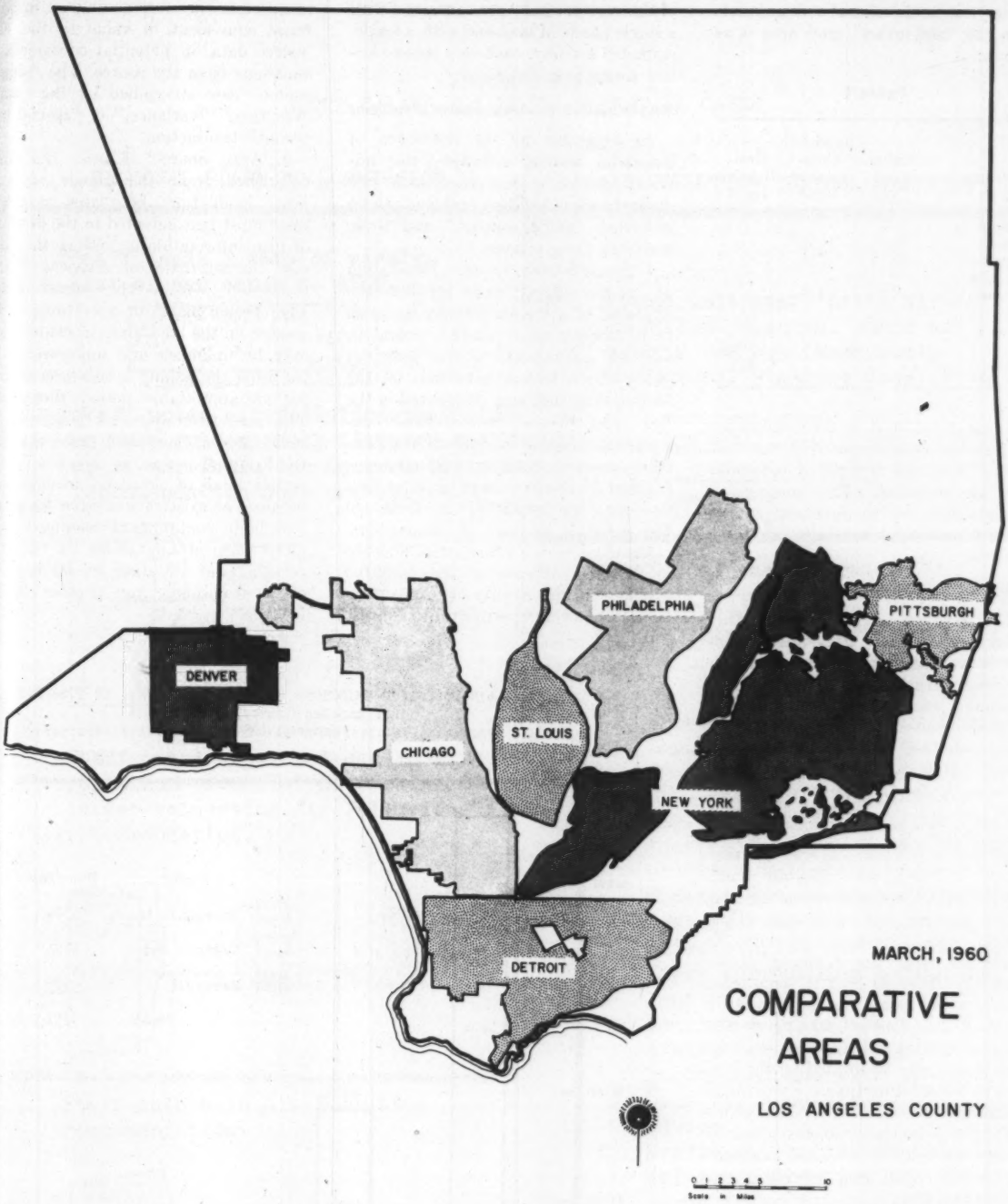

Fig. 2. Comparative size of the Los Angeles County Air Pollution Control District and other major air pollution control agencies.

heating occur. These loss ratios may also be modified by an increasing rate of population density as growth trends continue and as existing density regulations are relaxed, permitting higher building height limits, and the rezoning of land to accommodate multiple dwelling residential units.

When these typical urban land use classifications are modified to exclude the category of "Streets," the resulting product is defined as the "net urban" land area by the Los Angeles County Regional Planning Commission.[3] The exclusion of the "Streets" classification may be justified, on two grounds:

1 Zoning normally does not control the streets, which are publicly owned.

2 Contaminant emissions from "Streets" are a function of motor vehicle operations and there is a distinct possibility that these operations may soon be effectively controlled, at least in the State of California.

The relative emission of contaminants from the "net urban" land area is as follows:

Table I

Contaminant	Land Use: Industrial Land	Land Use: Commercial Land	Land Use: Residential Land
Organic gases	89%	11%	—
Aerosols	93%	7%	—
Inorganic gases	97%	3%	—
Total	93%	7%	less than 1%

As suggested by these data, the major air pollution problem posed by the "net urban" land use is that of industrial land use activities. The emphasis of the advisory service industrial zoning transactions was justified on these grounds.

Industrial Zoning Activities

The advisory service, then, is stuctured primarily to provide information relevant to proposed changes affecting industrial activities. These changes, or zoning transactions, are represented by three areas of zoning activity.

1 Districting of an industrial area, change or creation of a new industrial zone, on the land. This type of zoning case involves the establishment of a zone, such as light manufacturing, on a land area of considerable size. It may involve a change in zoning for a ten-acre site from agricultural, residential, or commercial, to industrial. Conversely, such a change may rarely be concerned with the rezoning of industrially classified land to some other nonindustrial zone. In any event a substantial amount of land is covered by the case, and several unknown activities may potentially be located on the land area at some future time. From an air pollution point of view, the case represents the potential problems posed by several unknown sources, and can therefore be described as a potential "area source" problem.

2 Modification or redesign of industrial zone classifications. Zoning actions of this sort involve a change in the precise definition of uses permitted in a major zoning classification. For example, an industrial zone may be modified so as to exclude certain types of industrial activities while permitting others to be conducted therein.

3 Issuance of zoning exceptions, variances, or special use permits. These actions involve the issuance of special use permits and the like which allow an activity to be performed in a zoning classification in which such an activity normally would be prohibited. Cases of this sort normally are concerned with a single parcel of land and with a single, definable activity, such as a steam electric generating station.

Single Source vs Area Source Problems

As suggested by the discussion of industrial zoning activities, the advisory service is concerned with two distinct case evaluation problems: those involving "single sources," and those involving "area sources."

1 "Single Source" Cases. Evaluation of "single source" cases involves the appraisal of a known activity in terms of its contaminant emission potential, and an assessment of the potential effect of the source operations on the surrounding land area designated in the case. The effect of uncontrollable contaminant emission increments and periodic source control malfunction—whether by mechanical or operator failure—may be predicted in terms of the general loading of atmospheric contaminants in a broad area, and the localized occurrence of air pollution problems in the vicinity of plant operations. Land uses peripheral to the site in question therefore assume an importance equivalent in value to the objective data on potential contaminant emissions from the source. The "single source" case is typified by the "zone exception," "variance," or "special use permit" transaction.

2 "Area Source" Cases. As distinguished from the "single source" case, evaluation of "area source" cases must be conducted in the absence of firm information indicating the specific characteristics of activities to be conducted within the zoned area. The specific plants or operations to be located on the land under consideration may be unknown and unknowable at the time the zoning action occurs and for an appreciable period thereafter. The analytical approach required by such cases is one which asks whether the location, per se, is undesirable for certain kinds of industrial development because of existing excessive local atmospheric contaminant loadings, local meteorological limitations on the dispersive and dilutive characteristics of the atmosphere, and/or other similar facts.

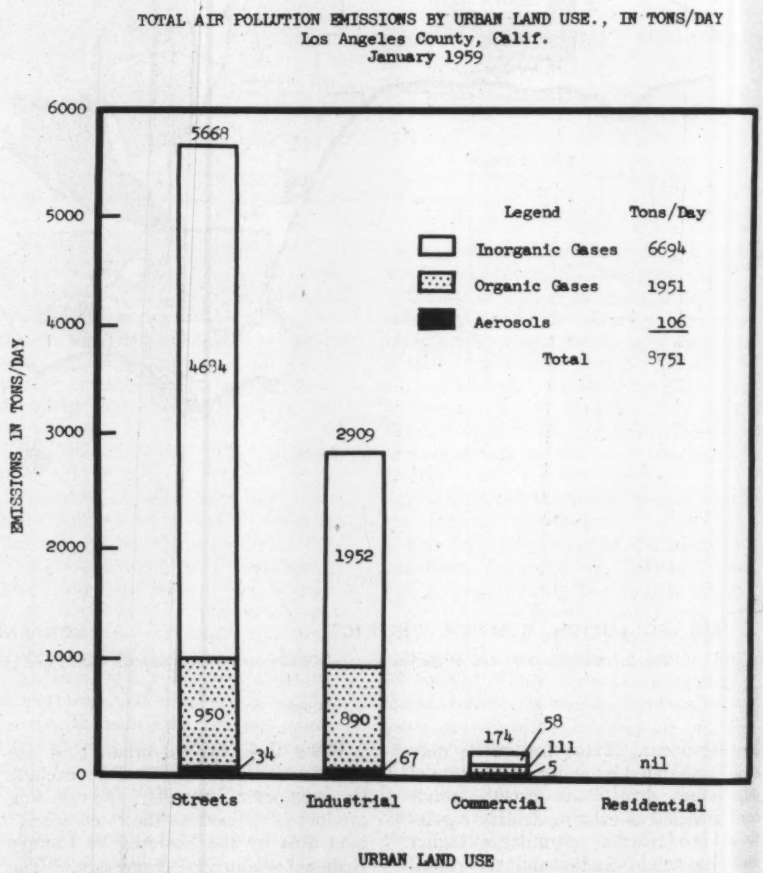

Fig. 3. Total air pollution emissions by urban land use, in tons/day. Los Angeles County, Calif., January 1959.

PROCESS CHART
GROUP I, AIR-POLLUTION-POTENTIAL CASES

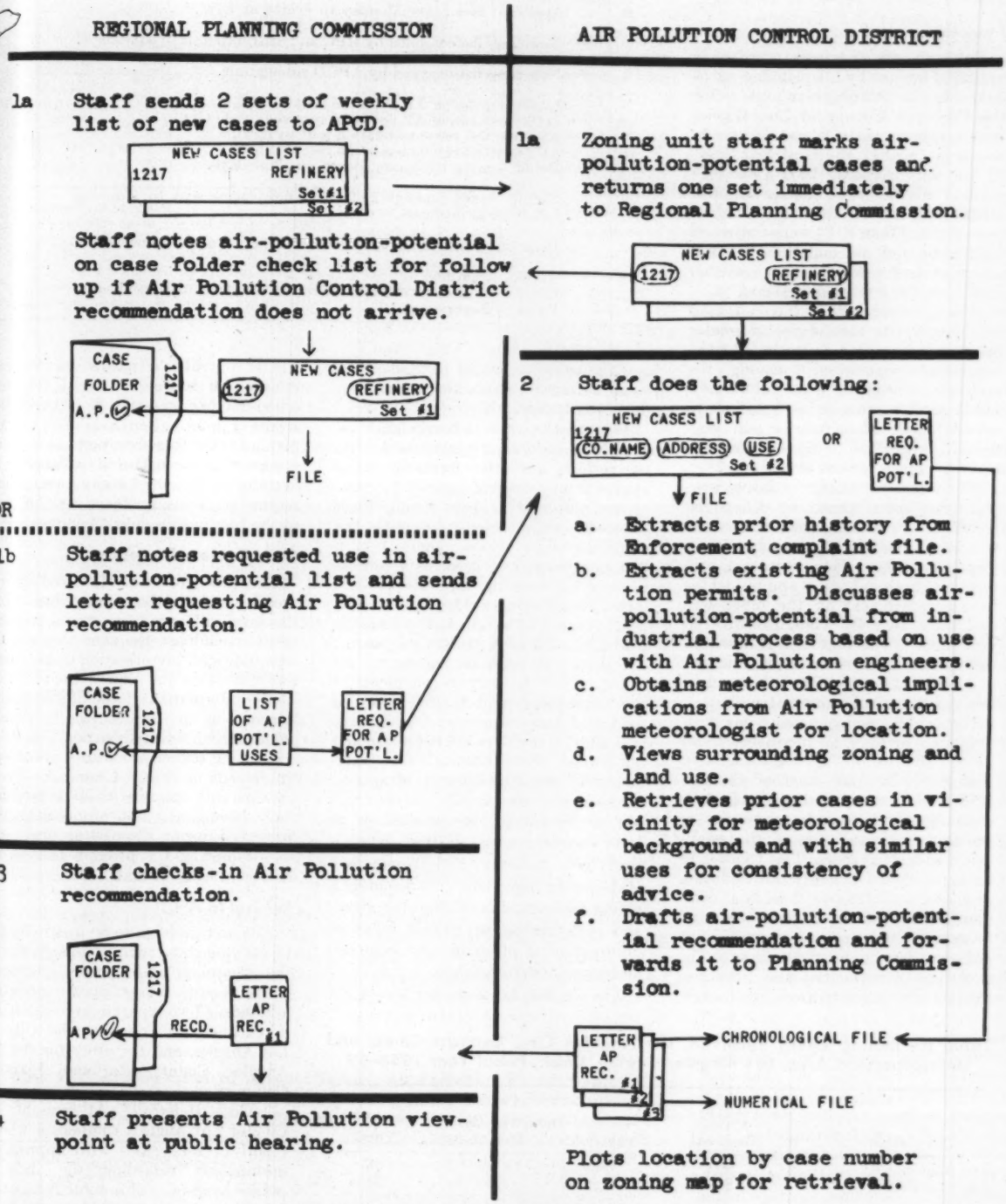
REGIONAL PLANNING COMMISSION
AIR POLLUTION CONTROL DISTRICT
1a Staff sends 2 sets of weekly list of new cases to APCD.
NEW CASES LIST
1217 REFINERY
Set #1
Set #2
1a Zoning unit staff marks air-pollution-potential cases and returns one set immediately to Regional Planning Commission.
NEW CASES LIST
1217 REFINERY
Set #1
Set #2
Staff notes air-pollution-potential on case folder check list for follow up if Air Pollution Control District recommendation does not arrive.
CASE FOLDER
A.P.
1217
NEW CASES
1217 REFINERY
Set #1
FILE
OR
2 Staff does the following:
NEW CASES LIST
1217
CO. NAME ADDRESS USE
Set #2
OR
LETTER REQ. FOR AP POT'L.
FILE
a. Extracts prior history from Enforcement complaint file.
b. Extracts existing Air Pollution permits. Discusses air-pollution-potential from industrial process based on use with Air Pollution engineers.
c. Obtains meteorological implications from Air Pollution meteorologist for location.
d. Views surrounding zoning and land use.
e. Retrieves prior cases in vicinity for meteorological background and with similar uses for consistency of advice.
f. Drafts air-pollution-potential recommendation and forwards it to Planning Commission.
1b Staff notes requested use in air-pollution-potential list and sends letter requesting Air Pollution recommendation.
CASE FOLDER
A.P.
1217
LIST OF A P POT'L. USES
LETTER REQ. FOR A P POT'L.
3 Staff checks-in Air Pollution recommendation.
CASE FOLDER
A P
1217
RECD.
LETTER AP REC. #1
LETTER AP REC. #1 #2 #3
CHRONOLOGICAL FILE
NUMERICAL FILE
4 Staff presents Air Pollution viewpoint at public hearing.
Plots location by case number on zoning map for retrieval.

Fig. 4. Process Chart—Group I, air pollution-potential cases.

Cases of this sort include changes in zone districting for large land areas or the modification of existing industrial zone classifications. Ultimately the land area in question will house several plants or activities and, therefore, comprises a multiple-source problem.

Typical Case Load

Although the advisory service is available for use by all planning agencies, only the planning commissions for the City and County of Los Angeles have made consistent use of it. As shown in Table II, the fiscal year 1958–59 saw approximately 1800 zone cases referred to the Air Pollution Control District for review. Of this number, however, less than 10% were concerned with industrial air pollution-potential activities and were formally reviewed with a resulting recommendation.

It is anticipated that this case load may increase in the future, as greater pressures are exerted on the land by the expanding population. Among the problems anticipated in the future, as a result of this pressure, is a reciprocal encroachment of industrial and residential properties on lands now exclusively zoned for one or the other.

The term, "mutually exclusive zoning," has been coined to define the technique of confining residential, commercial, and industrial uses only to their respective zones. This reciprocal protection of both industries and residences from encroachment by the other was first advocated by Pollard nearly 30 years ago.[4] This approach is based on the premise that each major land use is equally important to the development of the urban community.

Fortunately, some evidence has been presented to show an increasing trend toward the use of "mutually exclusive zoning."[5] In Los Angeles County, 50% of the local planning jurisdictions either do not have industrial zones or prohibit residential uses in the established industrial zones. This trend is to be applauded. Obviously, air pollution problems would not exist as local community annoyances if there were no "receptors" to receive contaminant emissions from industrial sources. The exclusion of residential uses from predominantly industrialized land areas, and the converse, would prevent many local nuisance complaints against industrial sources.

Fig. 5.

Time chart—group I, air pollution-potential cases.

Weeks	Process Description	Process Chart Number
0	Applicant files cases–Monday to Friday at RPC.	
1	——New cases list compiled by RPC and distributed on Wednesdays. 2 sets sent to APCD.	1a
2	——New cases list received by APCD zoning unit.	2
		1b
3	——Letter requesting AP potential sent to APCD.	
4	——Letter requesting AP potential received by APCD.	
5	——AP potential recommendation sent to RPC.	
	——AP potential recommendation received by RPC.	3
	——Public hearing by Zoning Board on Thursdays.	4
6	——Zoning Board findings and recommendations sent to Planning Commission members.	
7	——Planning Commission action—denial, approval, or continuance.	
8	——Applicant notified of final action. (Note: Additional time may be required if taken to appeal to the Board of Supervisors.)	

Nevertheless, the indiscriminate issuance of use zoning variances, special use permits, and other forms of official approval may operate against the concept of mutually exclusive zoning. Each proposed case of this sort requires the rendering of an official judgment by a planning body, and involves a process in which competing interests of land owner, neighboring resident, and industrialists must be weighed. The land use planning and zoning process is dynamic, not static. It must be constantly attuned to the changing requirements of the community, and to the expressed values of the community. In a very real sense, it involves the definition and application of community value judgments to the development of specific land areas. Necessarily, then, this process hinges on the evaluation of facts disclosing causal relations between land use patterns and community problems or objectives. It demands a sifting and weighing of opposing views, and is dependent on a wide range of information if effective and balanced decisions are to be reached.

The Zoning Advisory Service of the APCD provides a means for feeding information to the center of this decision-making process. It expands the scope of information available to the planner, and therefore permits him to render a more balanced judgment in keeping with the many competing requirements and objectives implicit in the community development process.

Case Review Procedure

The procedure now followed in reviewing industrial zoning transactions has been influenced by several requirements including: the time required for adequate staff investigation of the cases, and the need for timely presentation of the information at the official public hearing on the case so as to permit rebuttal by interested parties.

Existing review procedures are shown graphically in Figs. 4 and 5. To a considerable measure these procedures have been borne out of problems experienced during the past several years in attempting the prompt and timely review of case referrals.

Referral to APCD

The first problem to be met is that of identifying those zoning cases, filed with the planning and zoning authority, which require review by air pollution advisors. Two separate procedures are in current use: one for the City of Los Angeles, and the other for the Los Angeles County Regional Planning Commission.

1 City Referrals. At present the City of Los Angeles compiles a weekly report of zone cases with appropriate information regarding the date of public hearing. This total list is submitted to the District, where the list is reviewed to identify those industrial zone changes properly deserving of evaluation and comment.

Table II—Zoning Cases Received, Los Angeles City, Contract Cities, and Unincorporated Area, Los Angeles County, Calif., Fiscal Year 1958–59

Jurisdiction	Total Cases Received	Industrial Cases		
		Single Source	Area Source	Total
Los Angeles City	964	None	58	58
Los Angeles County[a]	844	38	36	74
Total	1808	38	94	132

Source: APCD files.

[a] Includes cases from five cities processed under contract by Los Angeles County.

Table III—Single Source Industrial Zoning Cases Approved with Air Pollution-Potential Recommendations, Los Angeles County Unincorporated Area, 1956

Type of Case	Total Cases Filed	Industrial Cases[a]	
		Total	Approved
Special permits	134	52	37
Zone exceptions	416	59	43
Totals	550	111	80

Source: RPC files.

[a] Industrial cases are defined to include only uses which have air pollution-potential. E.g., heavy construction equipment storage yard is classed as an industrial use by zoners but would not be included in above definition. A more lengthy title, but a more accurate one, would be "Air Pollution-Potential Cases."

2 County Referrals. The Los Angeles County Regional Planning Commission provides for its own screening of zone cases to identify those to be referred to the District for review and report. To assist them in this function, the District has reviewed a commission-prepared list of problem land uses and designated those which could present air pollution problems. This list now is used by RPC zoning personnel to identify zone cases to be submitted to the District, with an official request for review and report.

Internal Work Controls and Case Identification

Assuming no delay in transmittal of zoning cases to the District, approximately two to three weeks are available for case review and the submittal of an evaluation report and recommendation to the planning agency.

In "single source" cases the usual procedure involves the precise identification of the land area in question, a review of adjoining property uses, and a review of air pollution control experience with the site in question, the petitioner, and/or adjoining industrial activities. One problem noted in the review process has been the traditional zoning practice to identify special use and exception permits with the land parcel rather than with the operator. Since District source inventory and control records are maintained by operator, this conflict has produced some difficulty in properly identifying parcel and operator for case review.

The evaluation report itself is based on previous recommendations for similar uses; previous air pollution complaint history for the petitioner, the site in question, and adjoining properties; and on conferences with the appropriate District meteorologist and engineer. In the case of new sources, detailed meteorological computation may be made together with an assessment of the probable qualitative and quantitative characteristics of mass contaminant emission rates from the land area.

Zoning referrals are assigned for staff analysis to the District's "Zoning Co-ordinator" and require a labor expenditure of from $^1/_2$ to $1^1/_2$ man-days per week on this function, exclusive of clerical requirements. An internal work control system is utilized to assure prompt processing of zoning documents.

Single Source Zoning Cases

One sub-type of the single source zoning case is the conditional or special use permit case where a listed use is permitted only after a public hearing is held so that the neighboring property owners may voice their concern of the proposal prior to its establishment. The use permit procedure is commonly used for land uses which are problems due to the size of the land area required, its foot-loose locational quality, or its effect on the surrounding lands. Usually, if the conditional use or special permit is granted, one or more conditions are attached to soften its effects on the adjacent uses. Incidentally, some planners are of the opinion that every use should have a home in some zone classification and not be subject to the vagaries of the conditional use procedures.

Another type of single source zoning case is the exception or variance. The zone classifications are usually broad generalizations so that not every conceivable situation can be covered in an equitable manner. The exception or variance is akin to a relief valve to modify the zoning regulation to relieve hardship cases to the owner. As in the special permit case, conditions may be attached to balance the effects on the adjacent properties.

A study for the calendar year 1956 was made of the special use and exception cases under the jurisdiction of the Regional Planning Commission for the unincorporated area of Los Angeles County. Not all of the zoning cases for which air pollution recommendations were made could be analyzed due to attrition resulting from abandonment and denials, and thus become a moot question as shown in Table III. Of the 550 single source cases filed during the calendar year 1956 for the unincorporated area, about 20% were concerned with industrial uses. Of the total single sources only about 15% were eventually approved and granted.

The effectiveness measure, number of cases with air pollution recommendations ending up as conditions attached to the single source zoning cases, is shown in Table IV. In 86% of the single source cases, the air pollution-potential recommendations were effective, and in 64% the air pollution recommendations were adopted verbatim.

Area Source Zoning Cases

There have been instances where cities have created the various zone classifications, but have not applied any industrial zones within their jurisdiction. Others have applied industrial zones on marginal lands so that actual usable industrially zoned land was nonexistent.

Aside from the initial application of the industrial zones, there are many subsequent change of zone hearings to add or reduce the industrially zoned land. Thus, there are two phases: (*1*) the specific application of the zone on the land, and (*2*) the design of the zone classification.

District handling of a large area source case involving Agua Dulce-Mint Canyon area of Los Angeles County has been described by Holland, et al.[6]

The Los Angeles County experience indicates that zoning cases involving expansion or creation of industrial areas do not readily lend themselves to definite air pollution control analyses and recommendations. Within any industrial zone a mixture of land uses is permitted ranging from negligible to large potential air pollution emissions. In the absence of predictive information disclosing the precise activities to be conducted on the land, no definite estimate of potential emissions

Table IV—Effectiveness of Application of Air Pollution Recommendations Approved Single Source Zoning Cases, Los Angeles County, Unincorporated Area, 1956

Type of Case	Approved Cases No.	Recommendations vs Conditions Specifically	Generally	Not Included
Special permits	37	27 (73%)	8 (22%)	2 (5%)
Zone exceptions	43	24 (56%)	10 (23%)	9 (21%)
Totals	80	51 (64%)	18 (22%)	11 (14%)

Source: RPC files.

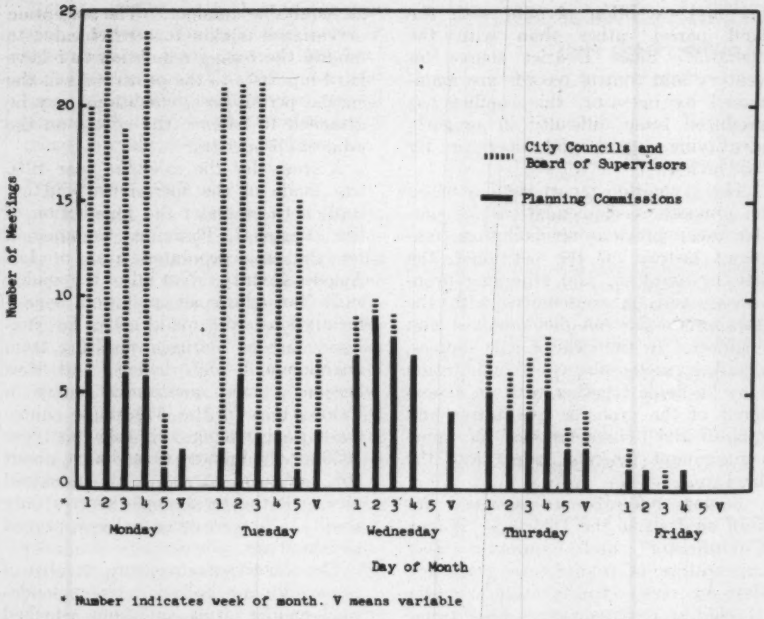

Fig. 6. Meeting days of 70 city councils, board of supervisors, and planning commissions, Los Angeles County, Calif., December 1959.

from the zone classification can be formulated. In view of the general spread of potential air pollution emitting activities throughout the several industrial zones, the possibility of modifying the zone classification itself has been studied.

It was assumed that by incorporating air pollution control requirements in the zone class specification, some of the difficulties in assessing the air pollution potential of a classification could be reduced. If air pollution control regulations could be built into the industrial zone classification, the regulations would apply automatically and would deter the need for individual case review except at the time of initial adoption of the zone class.

In general, the review of an area source case involves the following steps:

1 Meteorological parameters affecting the land site are identified.

2 Alternative means are identified for diffusing residual emissions of activities which may be located on the site so as to deter serious or nuisance peaks in atmospheric contaminant loadings. Among the meteorological factors considered are:

(*a*) Pattern and velocity of prevailing winds.
(*b*) Variations in inversion height.
(*c*) Stagnation areas affecting the site, viz.; regions of little or no wind movement for a period of time.
(*d*) Other geographical and climatological data. For example, if high pollution-potential activities are located in a pass or narrows, widespread pollution conditions might be created downwind. This kind of approach resulted in discouragement of industrial development in the Whittier Narrows area in eastern Los Angeles County.

3 Zoning and land use patterns of adjoining land areas are determined. This may be done by viewing the existing and proposed zoning and land use maps, or by actually viewing the site.

4 Prior recommendations for the same or similar sites are reviewed.

5 Estimation may be made of possible maximum contaminant emissions in the area, assuming adoption of the proposed zone change.

6 The report of evaluation and recommendation is drafted by the technician, reviewed, and submitted to the appropriate planning body.

Limitations of Advisory Service

General Planning Problems

Aside from the problem of the structure of the zone classification, administrative difficulties were anticipated in the interpretation of the air pollution control requirements by building inspectors and zoning enforcement agents. The consensus was that air pollution control specialists were needed to cope with the air pollution control requirement. A similar need for industrial waste specialists was previously acknowledged by civil engineers in the administration of industrial waste control in connection with building permits.

One recommendation of the expert committee on air pollution to the Governor of the State of California in the "Beckman Report"[7] was to co-ordinate the industrial zoning plan for air pollution with the many planning commissions in the Los Angeles area. While it is true that the planning commission is the advisory body on zoning matters, the final determination of any local zoning is made by the legislative body. To effectively carry out the suggestion of the "Beckman Report," equal co-ordination should be established with the commissions and the local legislative jurisdictions.

To determine the scope and staffing required to perform the task of co-ordination, by in-person representation at appropriate meetings, a questionnaire by the RPC staff of the meeting days for the legislative bodies and planning commissions was used. The 70 local agencies—city councils, Board of Supervisors, and planning commissions—in Los Angeles County hold over 300 meetings per month. With a few exceptions these meetings are night meetings and nearly 90% are held either on Mondays, Tuesdays, or Wednesdays. The planning commission meetings are half as frequent as the city council meetings and are not as clustered. The most popular commission meeting day is Wednesday, next Monday, then Thursday and Tuesday. On the maximum night each month, nine planning commissions meet simultaneously in different places in the county. There is an average of four meetings per night.

Assuming the experience encountered in the Agua Dulce-Mint Canyon zoning study, i.e., three meetings with the Commission and the Board of Supervisors, about 200 meetings would be required. In addition, there were 10 meetings on the staff level for every meeting with the planning commission and Board of Supervisors. A total of 2200 meetings would be required. Due to the change of elected officials and appointive officers, it may be necessary to go back to re-explain the zoning plan. Obviously, it is a huge task if a crash program is envisioned and must necessarily be lengthened out for a period of several years unless a temporary large staff is assigned to this task.

Personnel Continuity

The effectiveness of the zoning project can be measured by several methods. One method of valuation is the continuity of the personnel assigned to the industrial zoning task. In a new and emerging field there is no routine procedure. By necessity much of the experience is not available in written

form but must be created by original thinking, education, and experience in the related fields. The carryover of the industrial zoning experience can be obtained, however, at the various levels—policy making, supervising, or working—if personnel changes have to be made. During the years 1955 to 1957 considerable shuffling of personnel occurred due to the reorganization at the APCD. However, the total continuity was never seriously interrupted. Those presently assigned average four years continuous familiarity with this work.

Of more importance than the assignment of the same individual was the representation of administrative, chemical engineering, meteorological, and planning backgrounds of the personnel working on the project. It became evident that the team approach with various training represented is desirable to solve a project as complex as industrial zoning. It would be a rare instance when one person would have all the necessary education and experience needed to comprehend and solve such a diversified project.

Summary and Conclusions

Based on the air pollution-potential advisory service experience, the following summary and conclusions are presented:

1 According to the local population experts, continued large population growth can be anticipated for Los Angeles County. About 90% of this population is expected to cluster in the over 1200 square-mile Los Angeles Basin. The average rate of population growth forecast is about one million net growth every five years.

2 This anticipated population growth will sustain increased industrial activity with attendant increase in industrial air pollution emissions even after source control. The current industrial air pollution emission rate is about 3000 tons per day or about one-third of the total. If the major uncontrolled source (the automobile exhaust) is eliminated or reduced, the industrial emissions become the major source. For this reason, the preventive industrial land use control regulations, industrial zoning, must be researched, improved, and applied as a supplementary tool for a total air pollution control program.

3 Technical assistance to planning commissions concerning the air pollution-potential of industrial uses would be a logical first step in establishing air pollution-planning relationship.

4 Zoning cases are of various types, but for air pollution control they may be broadly classified as (*1*) specific single sources or (*2*) indefinite area sources. The specific single sources include the exception, variance, special permit, and conditional use types of zoning cases. The area sources include the establishment of industrial zoning classification and the application of the industrial zones to specific locations. The single source can be evaluated from an engineering approach while the area source can be evaluated from a meteorological approach.

5 The air pollution recommendations to alleviate future individual emissions can be incorporated as conditions of operation in the zoning program. The degree of co-operation may vary with the willingness of the local jurisdiction. However, in the experience of the unincorporated area of Los Angeles County, it was found that for specific single sources about 79% to 95%, depending on the zoning case type, of the recommendations were incorporated as conditions on approved cases.

6 Realizing that the air pollution-potential advisory service is only an interim program, there is a need to have additional research on a metropolitan-wide basis with assistance provided by the higher level of government and the universities.

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The RELATIONSHIP Between PEAK and MEAN Concentrations*,†

IRVING A. SINGER, Meteorologist, Brookhaven National Laboratory, Upton, Long Island, New York

In most industrial and municipal air pollution surveys, the method of predicting average concentration levels for various meteorological conditions is well understood. However, the many aspects of predicting short-period fluctuations of concentration are relative unknowns. The main purpose of this paper is to show the manner in which mean concentration patterns are built up from many short-term peak conditions and that a definable relationship exists between the peaks and the mean. Although the subject matter is essentially mathematical, the approach will be descriptive in nature. Use is made of actual data measured at Brookhaven National Laboratory to describe this complicated process, rather than mathematical equations.

The meteorological installation, oil-fog test facility, and local topography at Brookhaven National Laboratory have been described previously (Lowry,[1] Singer and Smith[2]). A 420 ft tower supports wind and temperature instruments as well as a 350 ft test stack from which oil-fog is emitted. The oil-fog is produced by condensation rather than combustion, and the resulting aerosol consists of droplets ranging from 0.05 μ to 3.0 μ with a mean radius of 0.3 μ. The settling rate is negligible when compared with natural diffusion processes, and both evaporation and coagulation effects are believed minor. The effluent may therefore be treated as a true aerosol.

The oil-fog has been measured by two very different techniques. Photometric densitometers, operating on the basis of the 90° scattering of visible light, have been used for continuous measurements at ground level. Since these instruments are expensive and a vehicle is required for the operation of each unit, no more than three have been used at one time. A second method involves the collection of oil-fog on molecular filters and measurement by a fluorometric device. This method permits measurement at a large number of points, but gives no indication of short-term variations. The calibration of both systems has been accomplished in a virtually airtight room having a volume of 200 m where oil-fog is introduced in known amounts by a miniature of the large field generator.

Laboratory accuracy has not been achieved with either of the field sampling techniques. In fact, it is quite difficult to evaluate certain aspects of this problem of accuracy, since no method of testing the sampling techniques has been found that does not also have relatively large errors. It is necessary, therefore, to use comparisons for an over-all evaluation of accuracy. The light-scattering and fluorometric techniques are good checks against each other. The former is very sensitive to variations in particle size but cannot "lose" an appreciable quantity of the effluent in the process of sampling. The reverse would be expected of the filter-fluorometer method. The oil-fog data summarized are believed to be accurate to ±10%.

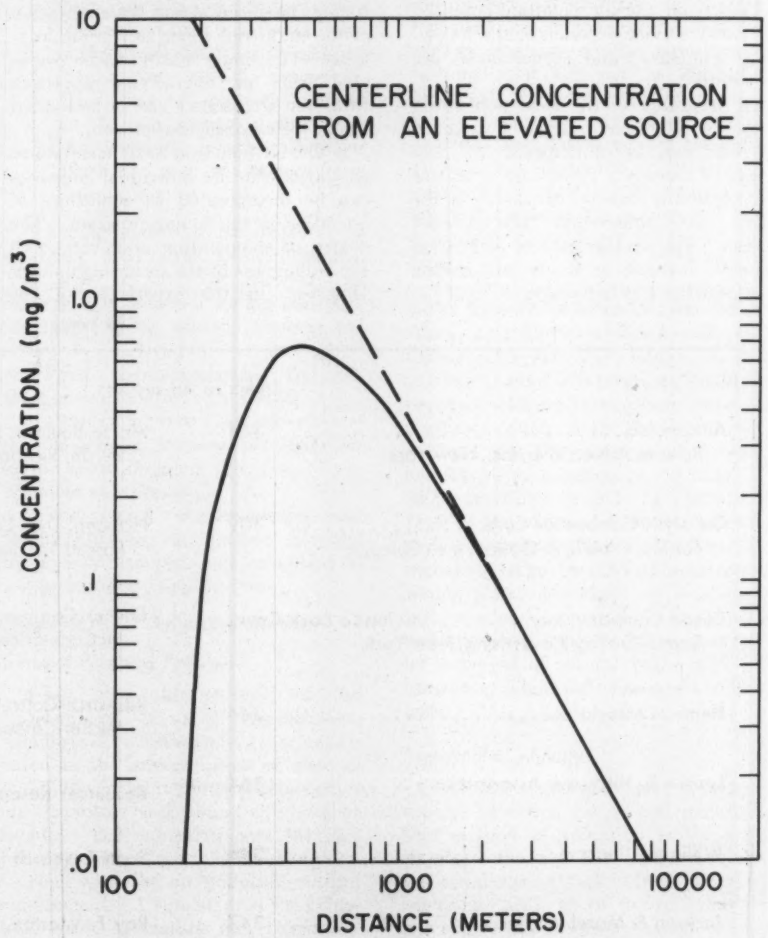


Fig. 1.

* Presented at the 53rd Annual Meeting of APCA, Netherland-Hilton Hotel, May 22–26, 1960, Cincinnati, Ohio.

† Research carried out under the auspices of the United States Atomic Energy Commission.

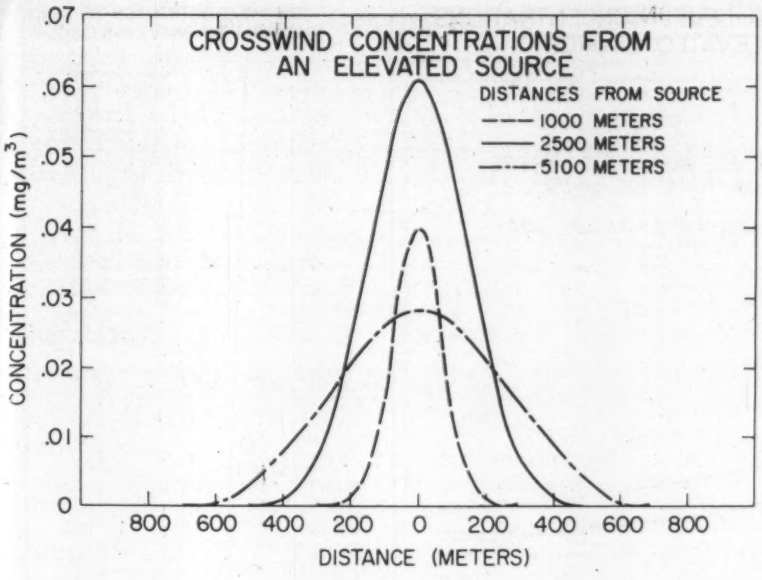


Fig. 2.

PLACEMENT OF FIELD SAMPLING DEVICES

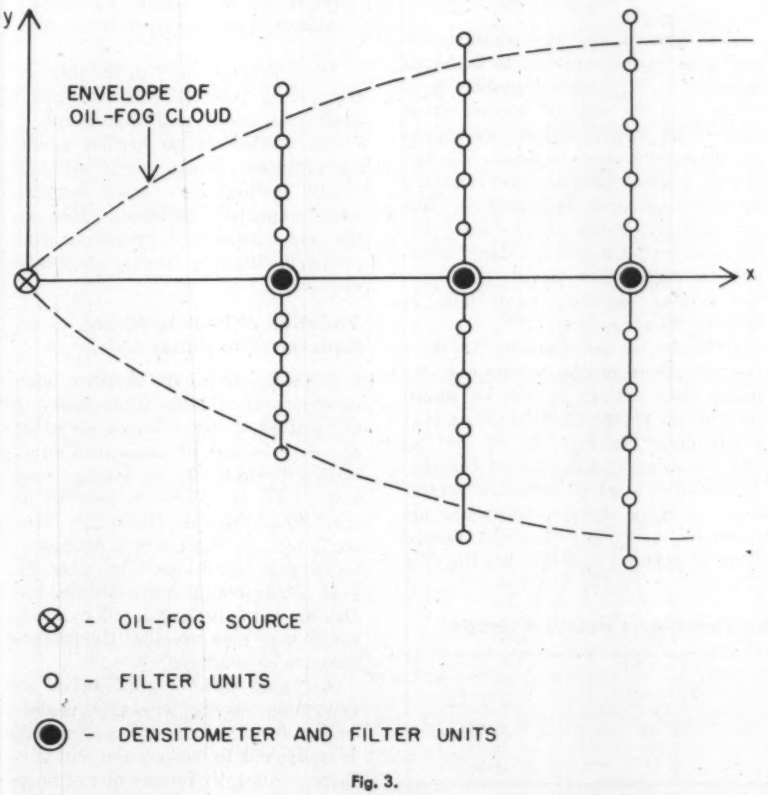


Fig. 3.

The oil-fog sampling instruments have been used in three different ways. The first and most common are continuous records of concentration at a fixed point over time periods ranging from a few minutes to several hours. It is from these densitometer records that all data on short-term variations are obtained. The densitometers have also been used to obtain series of traverses perpendicular to the wind direction. These give fair estimates of the mean cross wind profiles of the concentration and good estimates of plume width. In the third procedure, 10 or more filter samplers have provided accurate measurements of the average cross wind profiles at various distances from the stack. A method of predicting mean concentration is presented first, and its relationship to peak values is then shown.

Variation of Mean Concentration

The majority of diffusion theories (Bosanquet and Pearson,[3] Gifford,[4] Frenkiel,[5] Sutton[6]) describing the variation of mean concentration simply use alternate forms of a bivariate normal distribution function. Their main differences are in the exact form of the standard deviations. However, it is not the purpose of this paper to consider the merits of each theory, but just to describe the diffusion process in general. Since Sutton's equation (1) is most commonly known, it will be used to describe the dispersive powers of the atmosphere. The equation states that the ground-level concentration from an elevated continuous source is:

$$\bar{X} = \frac{2Q}{\pi C_y C_z \bar{u} x^{2-n}} \exp \left[-\frac{1}{x^{2-n}} \left(\frac{y^2}{C_y^2} + \frac{h^2}{C_z^2} \right) \right] \quad (1)$$

where:

- $\bar{X}$ = mean concentration (gm/m³)
- Q = rate of pollutant emission (gm/sec)
- C_y = horizontal diffusion parameter ($m^{n/2}$)
- C_z = vertical diffusion parameter ($m^{n/2}$)
- $\bar{u}$ = mean wind speed (m/sec)
- h = stack height (m)
- n = index of turbulence (dimensionless)
- x, y = downwind and crosswind distances (m)

This equation can be visualized most easily by plotting the distribution of concentration downwind and crosswind. The downwind concentration is shown in Fig. 1. Near the stack, the ground-level concentration is negligible and rapidly increases to a maximum value at some distance downwind. The concentration then decreases, and at large distances it falls off exponentially as

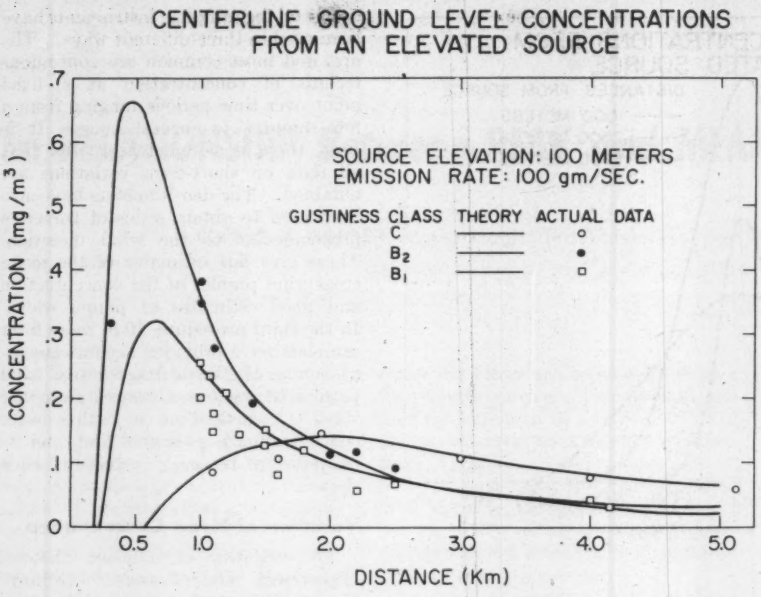
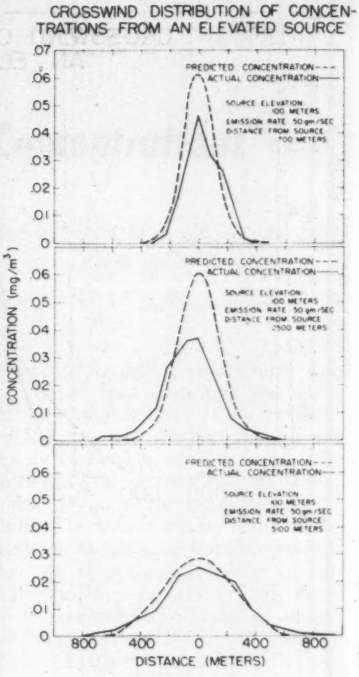


Fig 4.



Figs. 5a,b,c,

$1/x^{2-n}$, since the effect of stack height is negligible. The greater the instability, the faster the concentration decrease (n is smaller.)

The crosswind distribution of concentration is shown in Fig. 2. The equation states that the concentration is distributed normally about the mean wind direction at all distances and the width of the curve increases with distance. At this point, it must be stated that these conditions only exist as an average, and that individual patterns might be quite different.

This equation can be used to describe various atmospheric dispersion regimes by appropriate values of the diffusion parameters (C_y, $C_{z,n}$). At Brookhaven National Laboratory, these diffusion parameters are determined experimentally by emitting an oil-smoke from an elevated source and measured continuously at locations shown in Fig. 3.

By substituting the observed results from at least three distances into equation (1), the diffusion coefficients can be computed. The average values of these coefficients from many experiments are listed in Table I and subdivided according to gustiness.[8]

The absence of diffusion parameters for inversion (stable) conditions is due to the fact that during this condition the pollutant does not reach the ground from an elevated source. Thus, the equation does not apply and all general results and discussions apply only for lapse conditions.

The applicability of the above parameters can be seen in Fig. 4 where the theoretical curves using them are compared with actual data along the centerline of the plume.

The breakdown by stability or gustiness regimes appears to be satisfactory. B_2, most unstable—light winds, has the highest concentration close to the source, but the values decrease rapidly with distance. C, the strong wind—adiabatic case, has the lowest maximum concentration, but the values decrease slowly with distance and after a short distance actually are higher than the B_2 case. B_1, the typical day-time case, falls in between the other two.

It would be too confusing to show the variations in the y direction for many cases. Thus, it will be shown only for the C case where variation is at a minimum. In Figs. 5a, 5b, and 5c, the crosswind distribution of the theoretical and a set of actual concentrations at three different distances are plotted. It is clear that the normal form of Sutton's equation fits the data and, for this high wind-adiabatic case, the diffusion coefficients used produce excellent absolute values of concentration at all distances. The accuracy decreases with increasing instability, but still remains within an order of magnitude even during extreme conditions.

As stated previously in the introduction, it is possible with the aid of Sutton's equation and appropriate diffusion coefficients to predict average concentration levels which are sufficiently accurate for most industrial and municipal problems. However, the many aspects of predicting short-period fluctuations (peaks) are relative unknowns.

Table I—Current Values of Diffusion Parameters Hourly Average

Gustiness Type or Stability Condition	n	$C_y(m^{n/2})$	$C_z(m^{n/2})$
B_1 (unstable)	0.28	0.40	0.39
C (adiabatic)	0.48	0.54	0.34
B_2 (large instability)	0.17	0.31	0.36

Variation of Peak to Mean Concentration Ratios

A plume from an elevated source meanders about the atmosphere. At any instant of time, it is unlikely to have the distribution of concentration described theoretically for average conditions. To date there are only two new acceptable theories (Gifford,[4] Davidson[9]) relating short-period fluctuations to average conditions. It is the purpose of this section not to describe these theories but to present data for the readers, so they may visualize the processes that are encountered.

A typical trace of ground-level concentration varying with time is shown in Fig. 6. At times, the concentration is equivalent to background, but it can increase abruptly by an order of magni-

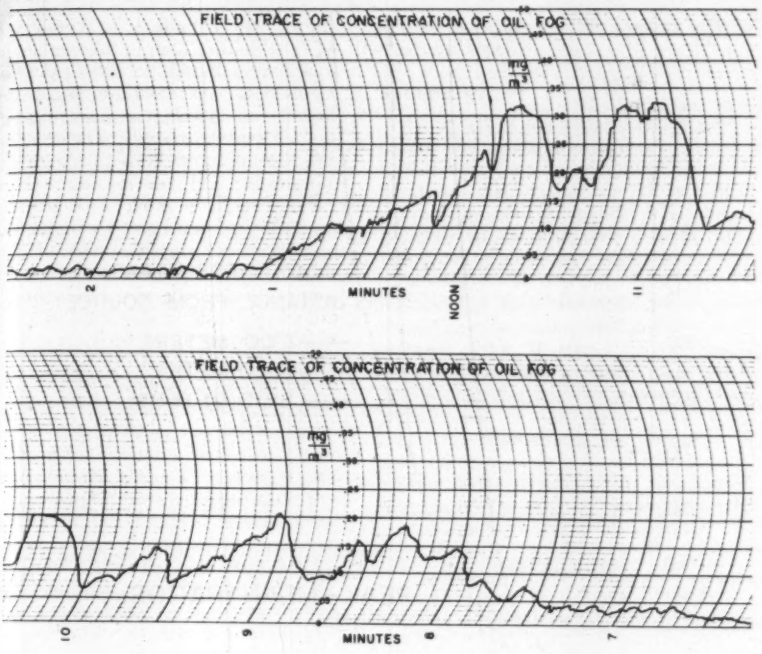
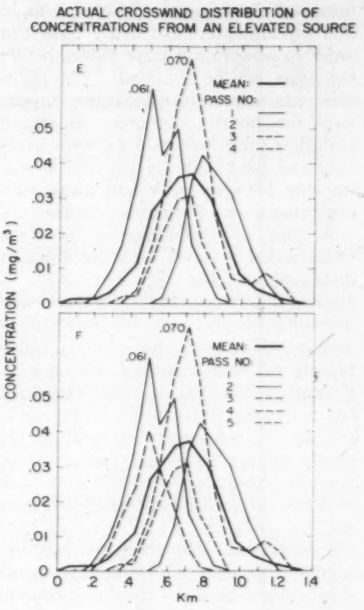
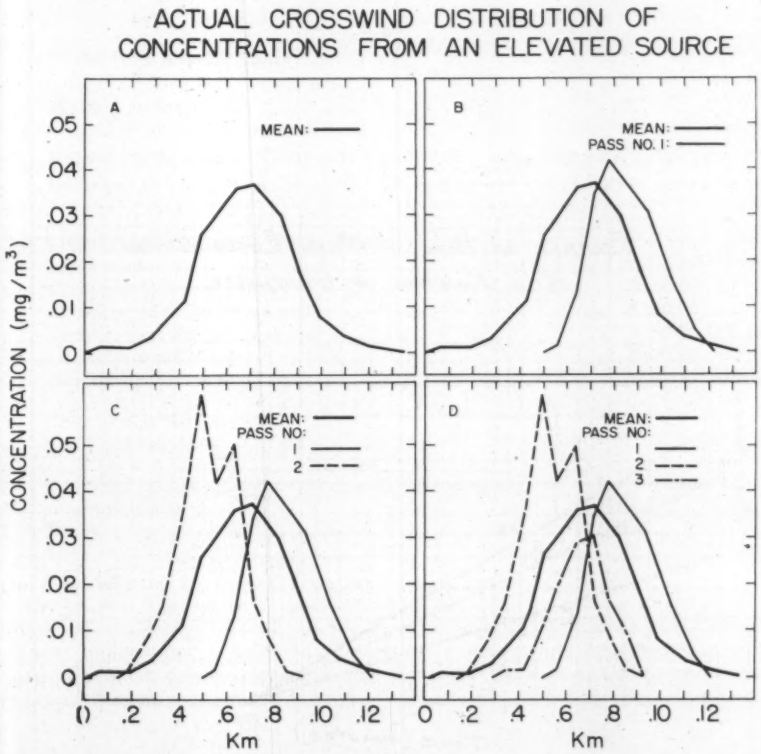


Fig. 6.



Figs. 7e,f.



Figs. 7a,b,c,d.

tude. The plume meanders about with the fluctuating wind patterns, and this occurs even during apparently steady conditions. The data presented in this section were taken during adiabatic, strong-wind conditions where the plume is very steady in appearance. Even under such conditions, the fluctuations of concentration are quite large. This is not a result of a sudden change of conditions, but is characteristic of the short-period movements of the atmosphere.

This process can be visualized better if one recognizes that an average crosswind concentration distribution is composed of many varying distributions. Again, the same steady, strong wind condition is used for demonstration purposes. The mean concentration curve at a distance of 2.5 K_m is shown in Fig. 4 and repeated in Fig. 7a. For this smoke test, trucks with the portable smoke densitometers passed back and forth across the trail measuring the concentration continuously. The first pass produced the concentration pattern shown in Fig. 7b. Two passes are reproduced on Fig. 7c and in subsequent figures more are overlaid until five passes are shown on Fig. 7f. Continuation of this plotting process would cause pure confusion, and the necessary features have already been shown. It is possible to see that at any instant of time the plume may not be normal, the absolute value may be higher or lower than the mean, and that the plume meanders around the mean wind direction and does not remain stationary. Since Sutton's equation applies to average conditions, it is necessary to measure concentrations

for a sufficient length of time or, as in this experiment, make many passes in order to smooth out peak values before the mean can be obtained. The diffusion parameters given in Table I apply only for hourly averages. In many pollution problems, shorter term averages and peaks are needed and a relationship between peak and mean concentrations would be of importance.

A plot of instantaneous peak to mean ratios is shown for three different distances in Fig. 8. The ratio is approximately two at the centerline and decreases slowly with distance downstream. However, the ratio increases rapidly as the crosswind distance, y, is increased. This can be visualized by reviewing Figs. 7b-7c. The peaks remain approximately the same as the plume swings back and forth. Thus, the peak/mean ratio increases because the mean concentration value decreases rapidly along the y axis outward from the centerline. However, the ratio remains approximately constant going downstream because the mean concentration values decrease very slowly along the x axis for this gustiness case. At large distances, the peak/mean ratio approaches a constant theoretically varying from one to two. It is believed by the author to be unity. The absolute value of this constant can be debated from a theoretical point of view, but is not of importance in this descriptive paper. However, the stability of the centerline peak/mean ratio with distance is of practical importance, since ratios at different distances can be combined to increase the statistical significance of the results. The work at Brookhaven has been extended along this line. The results in Fig. 9 show a summary of many experimental peak/mean ratios versus averaging time at the position of maximum concentration. The data again appear to divide themselves into three groups according to the gustiness. As expected, the greatest ratios occur with the most unstable case where large portions of the plume can be brought down rapidly to ground level. The smallest ratio occurs with the strong wind-adiabatic case where fluctuations are smaller, since we are dealing mainly with mechanical turbulence as in the case used as an illustration. This figure is important because it enables one to estimate peak/mean ratios from one time period to another. Let us assume we are able to predict the 100 minute mean concentration by means of Sutton's equation (1) and it is 10 mg/m³. If the gustiness was C, the peak one-minute concentration would be 40 mg/m³ and at 10 minutes it would be 20 mg/m³. If the gustiness was B_1, the one-minute peak concentration would be 85 mg/m³ and for B_2 case the one-minute peak concentration would be 140 mg/m³. The ranges or limits of the curves shown in Fig. 9

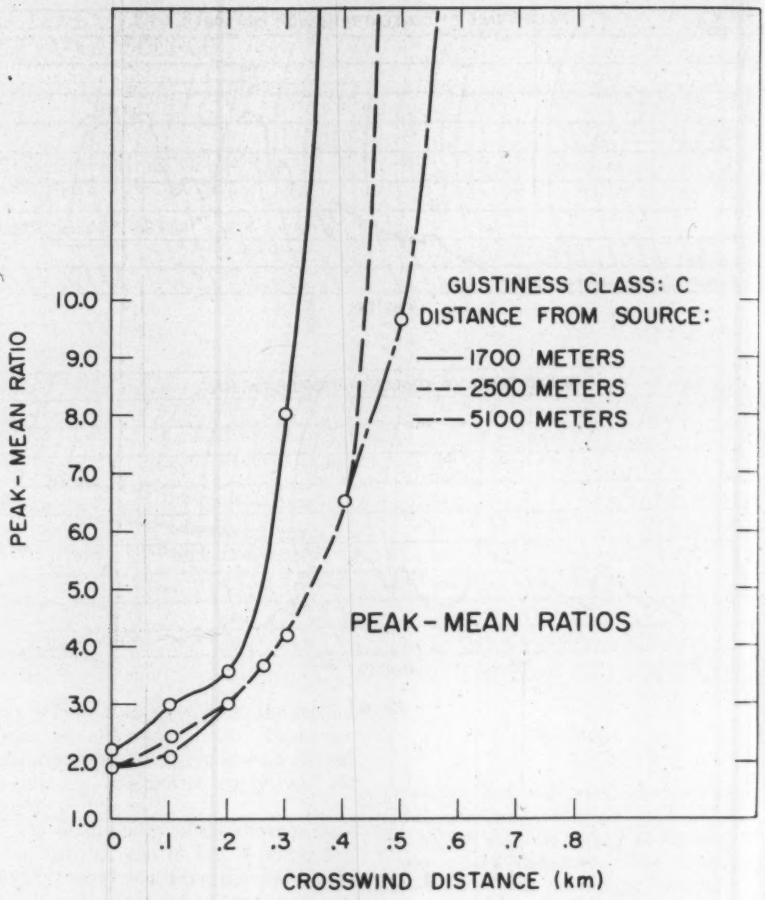


Fig. 8

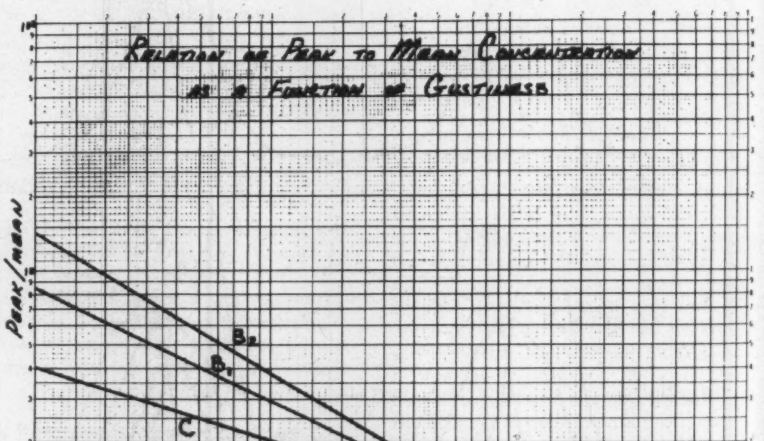


Fig. 9.

have not been evaluated due to the limited amount of data available. The reader is cautioned that these relationships do not imply that one can obtain a few short-term samples of an effluent plume and thereby reconstruct the entire concentration distribution from the Sutton equation and Fig. 9. On the contrary, it should be obvious from the discussion that small numbers of short-term measurements are the most dangerous sort of information in the air pollution field. In the first place, one does not know where the samples are taken in reference to the true location of the average maximum value; in the second place, without a large number of samples in the correct location, one cannot be sure that he has anything resembling the absolute short-term peak. As pointed out above, it is necessary by calculation or measurement to know the features of the average concentration pattern in order to make predictions of shorter term peaks. This study will be continued, and it is hoped that the prediction of peaks for time periods less than needed for average conditions will become a reality for the existing practical problems.

Summary

A method of predicting average concentrations has been presented. It has been shown that the simplified normal bivariate distribution describing the average concentration pattern is composed of various short-term periodic distributions which may differ from it significantly. A descriptive, empirical method has been described which indicates an exponential relationship exists between these shorter time or peak concentrations and average conditions. The slope of the exponent appears to be proportional to the stability or the gustiness. Downwind, the peaks are normally within an order of magnitude greater than average concentrations, whereas crosswind, the peaks may be several orders of magnitude larger.

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NEWS FROM THE CONTROL DISTRICTS

New York City

Increased activity by all units of the New York City Department of Air Pollution Control "helped to make 1960 perhaps the outstanding year for the Department, since it was established in 1952." This is the conclusion made in the Department's Annual Report.

"Most enforcement activities were at record or near-record levels," the report pointed out. "Control projects continued to be the major factor in preventing air pollution. Research on automotive pollution and pollution from incinerators went forward, indicating further advances which will reduce air pollution from these sources."

Commissioner Arthur J. Benline announced that the Annual Report was presented in the May issue of the Department's monthly publication, the Air Pollution Control *News*. The first presentation of the Report in this form was in June 1958, and covered the years 1956 and 1957.

The main body of the report deals with enforcement, control, research, legislation and co-operation and community action. Six additional pages are devoted to statistics.

Copies of the Annual Report may be obtained by writing to the following: Publications, Department of Air Pollution Control, 15 Park Row, New York 38, New York.

Bay Area

Disclosure of a survey showing that physicians have advised an estimated 10,000 patients to leave the Los Angeles Basin because of smog is seen as an endorsement of the Board of Supervisor's policy of dealing with smog as a critical health hazard, Air Pollution Control Officer Smith Griswold announced.

The survey, made jointly by the Los Angeles County Medical Association and the Tuberculosis and Health Association of Los Angeles County, showed that 77% of the county's physicians believe air pollution adversly affects the health of their patients, and that an estimated 2500 of the 10,000 patients advised to leave have done so.

"The air pollution control program in this county has operated on the premise that smog is a menace to health, even though we have never had the medical evidence to prove it." Mr. Griswold said. "Now that the medical picture is taking shape, we already have carried out the most stringent control program possible, and are going full speed to roll smog back to the pre-war level by 1965."

Mr. Griswold pointed out that industrial controls are keeping more than 3400 tons of pollution out of the air each day, that pollution from rubbish burning has been ended, and that an all out program is underway for the purpose of controlling auto exhaust.

"Let those opponents of our crash program who advocated waiting until we had more proof of the adverse effects on health, consider where we would be today if they had prevailed. This report is a grim warning that we dare not relax."

The health of future millions of residents requires that only the cleanest available fuels be burned in Los Angeles County, Smith Griswold told the State Public Utilities Commission.

Testifying at a hearing on an application by the California Gas Transmission Company and Southern California Edison Company to import gas from Mexico and Texas, Mr. Griswold said:

"We cannot increase the amount of air we have in this County, and on too many days it is overloaded with pollution now. The only way we can continue to grow is to protect our air supply, so that it can serve the millions who are here and the additional millions who are expected. We must use only the cleanest fuel available for our power plants, our industry, our homes, and our automobiles."

City of Columbus

On April 6, a committee from the United Community Council met with the Safety Director and the Smoke Regulation Engineer, regarding an atmospheric survey of the city. While we were pleased at the interest shown by the committee with regards to the components of the atmosphere in Columbus, we feel that they were evidently not aware of the thoroughness of the divisions work in air pollution control. Of particular interest to the committee was the BaP in the atmosphere. According to figures compiled by the United States Public Health Service, the BaP in micrograms per cubic meter in Columbus, is below any city of comparable size in Ohio.

The Smoke Regulation Engineer visited the Robert A. Taft Engineering Center in Cincinnati to keep abreast of any new developments in air pollution control. Columbus will be placed on the national network of air sampling along with high volume sampling.

Welcome New Members

Company Memberships (Local)

W. J. Clark Equipment Company
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Consolidated Electrodynamics Corp.
Pasadena, California

Davies and Baird Pty. Ltd.
Melbourne, Australia

Government Agency Membership

Air Pollution Control District
Los Angeles, California

Individual Memberships

Arestad, O. T.
The Dalles, Oregon

Barthel, C. E., Jr.
Alexandria, Virginia

Berg, J. A.
Seattle, Washington

Boudreaux, Frank
Baytown, Texas

Brief, Richard S.
Linden, New Jersey

Brown, Donald V.
Appleton, Wisconsin

Brown, Jack L.
Seattle, Washington

Currie, Harriett E.
San Francisco, California

Dahle, Elkins W., Jr.
Baltimore, Maryland

Davis, M. W.
Bridgeport, Connecticut

DeBuse, Stanley H.
San Francisco, California

Dittrich, William J.
Bellingham, Washington

Fahnestock, Frank C.
New York, New York

Feuer, Mrs. Stanley
Beverly Hills, California

Gay, James P.
Johnstown, Pennsylvania

Geisheker, Bernard J.
Milwaukee, Wisconsin

Goerner, Steve
Pasadena, Texas

Guild, Lloyd V.
Pittsburgh, Pennsylvania

Hamming, Kenneth W.
Chicago, Illinois

Helmers, E. Neil
Beaumont, Texas

Hutton, G. W.
Wenatchee, Washington

Killackey, Raymond W.
Pittsfield, Massachusetts

Kirby, Don
Los Angeles, California

Kraissl, Frederick, Jr.
North Hackensack, New Jersey

Lux, John F.
Buffalo, New York

Markson, Richard
Pittsburgh, Pennsylvania

Merrill, John R.
Vancouver, Washington

Mohr, T. P.
Los Angeles, California

O'Driscoll, K. P.
Stroud, Glouchestershire, England

Ross, C. R.
Ottawa, Ontario, Canada

Rzigalinski, Joseph A.
Sayreville, New Jersey

(*Continued on p. 343*)

★ ★ ★ Section Hi-Lites ★ ★ ★

West Coast Section

Over 70 guests attended the West Coast Section's recent dinner meeting at Riverside, California. The meeting featured talks by George Zaal and August T. Rossano, Jr., Ph.D., plus an impromptu celebration of California Institute of Technology Professor Emeritus, Royal W. Sorensen's, 79th birthday.

Mr. Zaal, Air Pollution Specialist of the Riverside Cement Company, discussed the manufacture of Portland cement and the inherent dust control problems. He covered the operations at Riverside Cement's several plants and the measures used to control dust. Mr. Zaal pointed out that cement kilns themselves were the most difficult to control because of the large volume of high temperature, high humidity gases exhausted and because of the high dust concentrations in these gases. He noted that his firm is using glass fiber bags in the baghouses to be installed at their new plants. Kilns are, however, not the only source of dust at cement plants. As an example he pointed out the 240,000 square foot filter cloth used in the baghouse at their Oro Grande plant to control dust from primary and secondary grinding. A particularly interesting point of Mr. Zaal's talk was his description of the pioneer electrical precipitator built between 1909 and 1913 by Professor Cottrell and Walter Schmidt at Riverside's Crestmore plant. This precipitator is still in operation today.

Dr. Rossano of the U. S. Public Health Service, in his talk, titled, "Is the Current Economic Expansion Threatening Our Environmental Health?" voiced concern over the potential health hazard posed by industrial expansion in Southern California. Currently setting up an environmental health curriculum at the California Institute of Technology, Dr. Rossano pointed out that dilution air is extremely limited in this area. He expressed doubt that the control of vehicular emissions would provide a permanent cure because of the anticipated expansion. The population of Southern California is expected to double in 20 years. He stated that industrial growth is desirable, only if environmental health is not endangered; and this area may have a maximum concentration of both people and industry, which is limited by both air and water pollution.

Niagara Frontier Section

The regular meeting of the Air Pollution Control Association-Niagara Frontier Section was held recently in Buffalo, New York. This was the annual meeting held jointly with the New York Water Pollution Control Association-Western Section.

Ninety members and guests were present, including members of the Water Pollution Control Association.

The guest speaker, Andrew J. Fuller, Regional Director of Public Health Engineering, New York State, Department of Health, Rochester area, addressed the group on "Joint Problems and Responsibilities of Air & Water Pollution Control Engineers." Mr. Fuller first directed his remarks to the WPCA members and reviewed the status of the State law. He noted surveys were 95% complete and 60% of State waters have been classified. He stated that, on the abatement phase of this program, they were securing personnel and accelerating their work in the Finger Lakes area.

Mr. Fuller reviewed the problem encountered in defining air pollution, and the fact that pollution problems, where they exist, are generally subjective judgments from individuals and neighborhoods.

Mr. Fuller then discussed the joint problems concerning both groups. He cited a number of examples where collected affluent became a water problem and then later a public nuisance. He noted in some instances municipalities, that were anxious for new industry, did not thoroughly investigate individual industries for possibilities of water pollution problems. In one example, the location of an odor source required the joint effort of air and water pollution engineers as well as assistance from local residents.

Paraklon System Installed in London

Paraklon, the system developed by Svenska Fläktfabriken for high-efficiency mechanical precipitation, is to be installed at the Deptford power station in London, the Swedish company reports.

Fourteen Paraklon units, each capable of handling 128,000 cubic meters of gas per hour, will be used for purifying the smoke gases from the coal-fired boilers at the power station. The order, obtained by Svenska Fläktfabriken's British licensees, E. Green and Son, Wakefield, is reported to be worth about Kr. 2,000,000 (£138,000; $400,000) and was secured in face of keen competition with local manufacturers.

Annual Coal Conference To Be Held in October

The annual Industrial Coal Conference sponsored by the School of Mechanical Engineering and Division of Adult Education, Purdue University, Lafayette, Indiana, in co-operation with the Mid-West Coal Producers Institute, Inc., National Coal Association and the National Association of Power Engineers, will be held on October 11 and 12, 1961, in the Memorial Union Building, Lafayette. A tentative program has been announced with the following subjects listed on the agenda: Important Safety Devices Essential to Every Coal-Fired Industrial Boiler; Feedwater Chemistry-Internal Treatment for Units Under 250 psig; Preventive Maintenance of Industrial Power Equipment; Fitting the Coal to the Existing Plant; Fitting the New Plant to the Available Coals; Plant Economics: (*a*) Record Keeping in the Small Plant; (*b*) The Selection and Use of Controls for Small Plants; and (*c*) Actual Operating Efficiency vs Efficiency Potential; Progress in Coal-Fired Packaged Boilers—(*a*) Low Pressure Units, and (*b*) Medium Pressure Units.

East Central Section Annual Technical Meeting—September 21, 22, 1961, Louisville, Kentucky

Technical papers on air pollution control and related subjects are solicited for presentation.

For further information write to:
Ralph W. Bourne, Room 2, City Hall, Louisville 2, Kentucky

Welcome New Members

(*Continued from p. 342*)

Samuels, R. C.
Trona, California

Schwartz, Donald J.
Buffalo, New York

Schwendiman, Lysle C.
Richland, Washington

Smith, Walter
Cambridge, Massachusetts

Spence, G. M.
Monolith, California

Spencer, Emmet F., Jr.
Fremont, California

Stalker, W. G.
Pittsburgh, Pennsylvania

Swann, John J.
Olympia, Washington

Tuschhoff, J. W.
Clarkston, Washington

Vatet, John V.
Ashland, Kentucky

Willard, Frank J., Jr.
Philadelphia, Pennsylvania

Windish, J. P.
Ottawa, Ontario, Canada

Wortreich, Herbert
West Caldwell, New Jersey

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Industrial Hygiene Board Issues IH Certification

The American Board of Industrial Hygiene invites inquiries from those who are interested in applying for voluntary certification in the profession of industrial hygiene. Certificates will be issued on the basis of an examination to those who have eight years of practice, following a suitable baccalaureate degree.

No examination will be required of those who have 15 years of practice with recognized contributions to the field, following acceptable education. Certain specialists within the field will be certified when one-fourth of their time has consistently been devoted to application of their specialty to industrial hygiene. A brochure describing the certification program, and giving more details of eligibility will be sent to those who direct inquiries to Henry F. Smyth, Jr., Secretary-Treasurer, American Board of Industrial Hygiene, 4400 Fifth Avenue, Pittsburgh 13, Pennsylvania.

The Board was chartered as a nonprofit corporation under the laws of the Commonwealth of Pennsylvania in September 1960. The incorporators were selected by the American Conference of Governmental Industrial Hygienists and the American Industrial Hygiene Association from among their respective memberships. They are John C. Soet, Chairman; Lester V. Cralley, Ph.D., Vice-Chairman; Henry F. Smyth, Jr., Ph.D., Secretary-Treasurer; and Edgar C. Barnes, William R. Bradley, Allan L. Coleman, Hervey B. Elkins, Ph.D., Louis F. Garber, Thomas F. Mancuso, M.D., Kenneth M. Morse, James H. Sterner, M.D., and Charles D. Yaffe.

In Memoriam . . .

It is with deep regret that we announce the death of Manfred Bowditch, who contributed a great deal to APCA.

LAUREN B. HITCHCOCK ASSOCIATES

Chemical Engineers

INDUSTRIAL AIR POLLUTION ABATEMENT

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John H. Schaefer
Richard O'Mara, O'Mara Associates
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60 East 42nd St., New York 17, N. Y.
YUkon 6-4628
2 East Main St., Richmond 19, Va.
MIlton 3-5138

Booklet on Request

PHS Announces Research Project

A major research project is now underway which should add valuable information to what is known about the health effects of air pollution, the Public Health Service has announced.

The study is a joint project with the Los Angeles County Air Pollution Control District, and the University of Southern California to observe the effects on laboratory animals—mice, guinea pigs, and rabbits—of breathing the same air breathed by people in Los Angeles County.

The contaminants of primary interest are those specifically associated with automobile exhaust—hydrocarbons, oxidant, carbon monoxide, oxides of nitrogen, and certain particulates.

While the test animals breathe the air at special sites located at varying distances from the heavily traveled throughways, a control group of similar animals will be living in purified air from which contaminants have been removed.

The study represents the largest research effort of its kind yet undertaken in the field of air pollution.

Commenting on the agreement Dr. L. Otis Emik, Division of Air Pollution, Public Health Service, stated: "In this field of study we have long needed careful observations of the effects on laboratory animals of precisely the same exhaust contaminated air which people breathe. These observations may give us the opportunity to observe in animals, during short periods of time, effects which in human beings might take decades to occur."

S. Smith Griswold, Director, Los Angeles County Air Pollution Control District will direct the establishment of four stations at which pollutants will be monitored and animals studied. The initial contract, at a cost of $152,000 will cover the establishment, operation, and maintenance of these stations until June 15, 1961.

The University of Southern California will furnish and operate facilities for housing the exposed and control animal colonies, on the grounds of the University Medical School and at sites provided by the Los Angeles County Air Pollution Control District.

The work at the University of Southern California will be under the general direction of Dr. Leslie A. Chambers, Director of the Allen Hancock Foundation. Members of the faculty of the Medical School who will participate include: Dr. Paul Kotin, Assistant Professor of Pathology; Dr. Oscar J. Balchum, Assistant Professor of Medicine; Dr. John Mehl, Chairman of the Department of Biochemistry.

Personalia

Ralph L. Chamberlin has been appointed to fill the new post of Director of International Operations with Research-Cottrell, Inc. Mr. Chamberlin will have full authority and responsibility to conduct the operations outside the United States and Canada.

Mr. Chamberlin is an officer of the company and secretary of the Board of Directors. During his service with the company, he has been estimating engineer, assistant pre-contract engineer, chief of the engineering department process station, manager of the products engineering department, and until his present appointment, director of engineering.

* * *

Fred L. Doolittle has been elected president and chief executive officer of the Penn-Dixie Cement Corporation. He will succeed Barton W. Druckenmiller who has been elected chairman. The Penn-Dixie Cement Corporation is a company member of APCA.

* * *

William C. Grimes has been named senior field service engineer for the Scientific and Process Instruments Division of Beckman Instruments, Inc. Prior to his new appointment Mr. Grimes was field service engineer for the division's western region.

In his new assignment, Mr. Grimes will handle the installation of Beckman's infrared instruments and allied equipment in all parts of the country.

* * *

William C. Mackie has been appointed Midwest District Sales Manager for Rhodia, Inc. Formerly West Cost District Manager, Mr. Mackie has had more than 20 years experience in the aromatic chemical field. **Everett J. Weaver** has been named Mr. Mackie's assistant. He was previously in charge of the Southern territory for Rhodia.

* * *

Jerome Wilkenfeld, Technical Superintendent of Hooker Chemical Company, was honored for significant contributions toward the control of air pollution during 1960 by the Niagara Frontier Chapter of the Air Pollution Control Association at the fourth Annual Awards dinner held at the Red Coach Inn in Niagara Falls May 25.

Mr. Wilkenfeld is a member of the Air Pollution Abatement Committee of the Associated Industries of New York State, is an officer of the Water Pollution Abatement Committee of the Manufacturing Chemists' Association, and has been a member of the State Air Pollution Control Board since its inception.

PUBLIC HEALTH HOLDS HEARINGS TO ADOPT CONTROL REGULATIONS

The Department of Public Health, acting in accordance with provisions of Chapter 30A of the General Laws, held a public hearing in the Gardner Auditorium, State House, Boston, Massachusetts, on May 26, 1961, at 10:00 AM, relative to the adoption of regulations to prevent pollution or undue contamination of the atmosphere within the Metropolitan Air Pollution Control District, authorized under the provisions of Section 142B of Chapter 111 of the General Laws.

The proposed regulations will provide that:

(*1*) "No person owning, leasing, or controlling the operation of any air contamination source or sources shall willfully, negligently, or through failure to provide necessary equipment or facilities or to take necessary precautions, permit the emission from said air contamination source or sources of such quantities of air contaminants which will cause, by themselves or in conjunction with other air contaminants, a condition of atmospheric pollution"; and that

(*2*) the use in or sale for use in hand-fired furnaces of coal having a volatile matter content of 24% or more is prohibited, and that

(*3*) the approval of the Department would be required of plans for (*a*) incinerators having a capacity of 10 tons per day or more or having a horizontal grate area equivalent of 10 sq ft or more, and (*b*) of thermal energy utilization units and appurtenances, using coal and/or oil as a source of energy, and having an energy input capacity of at least one hundred million (100,000,000) British Thermal Units per hour, and that

(*4*) the emission from stacks of smoke having a degree of darkness equal to or greater than number two of Ringelmann's Chart for more than six minutes in any one hour is prohibited, and that

(*5*) no open burning shall be conducted unless a permit has been issued therefor in accordance with Section 13 of Chapter 48 of the General Laws. Such permits would require further approval by the Department of Public Health except for permits issued for the burning of trash by residents of buildings of three dwelling units or less, the burning of leaves, and for outdoor cooking fires. It is the Department's intention that the open burning of refuse, except as mentioned above, will be prohibited and that open burning for salvage purposes will be prohibited after c. July 1962.

The Department of Public Health will hear such evidence as may be submitted relative to the proposed regulations and will incorporate into the records of the public hearing such communications as are received prior to the date of the hearing. Copies of the proposed regulations to prevent pollution of the atmosphere have been forwarded to each board of health in the Metropolitan Air Pollution Control District and are on file in the office of the Commissioner of Public Health, Room 546, State House, and the Division of Sanitary Engineering, Room 511.

STEEL INDUSTRY LAUNCHES PROGRAM

The steel industry has launched a 10-year program which will clean up Allegheny County, Pittsburgh, Pennsylvania, skies. Costs will be in excess of $25 million.

The program will involve open hearth furnaces, electric furnaces, and sintering plants. They will be brought into compliance with requirements of the County smoke control ordinances by the end of 1965. The schedule proposes that open hearth furnaces will be equipped with cleaners by the end of 1970; electric furnaces will be under control by the end of 1971. The four sintering plants in Allegheny County are already equipped with gas cleaning equipment. However, some modifications to the plants will be necessary to bring them in compliance with the new and stricter regulations. The schedule calls for completion of the modifications by 1965.

The program has been submitted to the Board of Health for approval.

Funds must be appropriated by the management of each company for its own installations.

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Boston—Washington—New York

55th ANNUAL MEETING

MAY 20—24, 1962

CHICAGO-SHERATON HOTEL

CHICAGO, ILLINOIS

Invitation for Submission of Papers

55th ANNUAL MEETING

of the

AIR POLLUTION CONTROL ASSOCIATION

CHICAGO-SHERATON HOTEL, CHICAGO, ILLINOIS

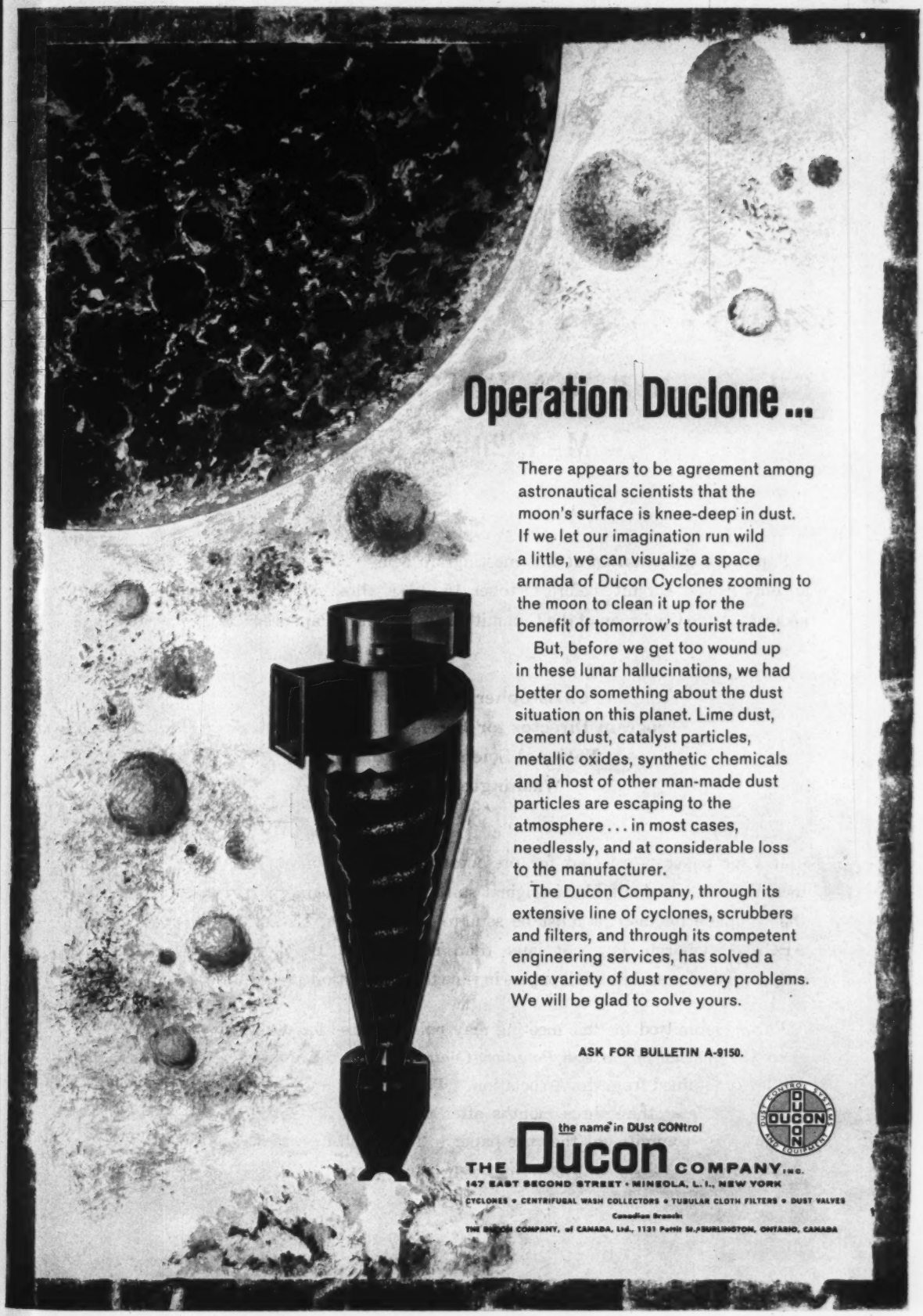
MAY 20–24, 1962

Papers for presentation at this meeting are being solicited, and any interested authors should submit, before October 15, 1961, three copies of the title and abstract to the Chairman of the Committee on Technical Papers and Program:

Christopher E. Barthel, Jr.
Program Director for Foreign Science Activities
National Science Foundation
Washington 25, D. C.

If your paper is selected for presentation by the Committee—three copies, including one clear-cut black original suitable for photographic reproduction, of the complete manuscript must be sent to Arnold Arch, Executive Secretary of APCA, Pittsburgh, Pa., not later than February 1, 1962. This will permit preparation of preprints of all papers in time for distribution at the meeting.

Papers submitted for this meeting may not be offered for publication elsewhere than the *Journal of the Air Pollution Control Association* unless specific written release is obtained from the Association. The Association will, however, give the author not later than three months after the date of presentation of the paper either a firm commitment that the paper will be published in the *Journal* of the Association or a release for publication elsewhere.



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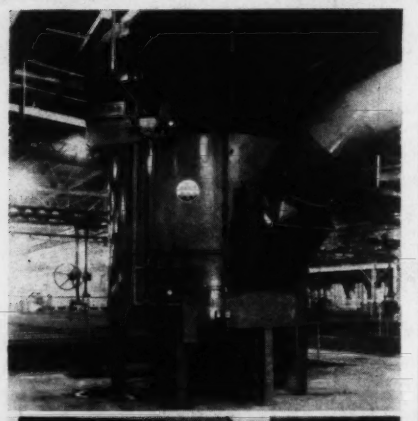

Top: 30,000 cfm Hydro-Filter similar to this one maintains above 95% efficiency. Handles dust and fume load from plant's dryers, cooler and ammoniator.

Bottom: Water is recirculated through collector from this 2500 gallon tank.

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